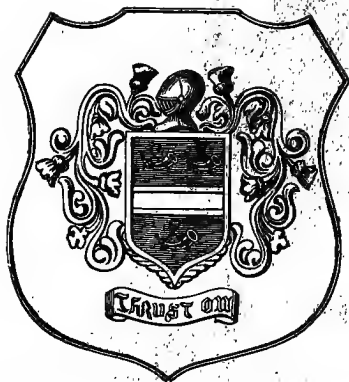


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REPORT
TO THE
Worshipful Clothworkers' Company
ON THE
WEAVING & OTHER TECHNICAL SCHOOLS
OF THE CONTINENT





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REPORT
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OF LONDON
ON THE
WEAVING AND OTHER TECHNICAL SCHOOLS
OF THE CONTINENT

REPORT
TO THE
Worshipful Clothworkers' Company
OF LONDON
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WEAVING AND OTHER TECHNICAL SCHOOLS
OF THE CONTINENT

With General Observations and Suggestions as to
the Best Mode of Extending and Improving the Textile
Industries Department of the Yorkshire College of Science,
Leeds, and of Establishing other Technical Schools
throughout this Country.

BY
WALTER S. B. ^{right}McLAREN, M.A.
(SMITH AND McLAREN) OF KEIGHLEY

AND

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*Instructor in the Textile Industries Department of the Yorkshire College of
Science, Leeds*
(ESTABLISHED AND ENDOWED BY THE CLOTHWORKERS' COMPANY)

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**CLOTHWORKERS' HALL,
MINCING LANE, LONDON,
*January 1877.***

[NOTE.—In July, 1876, the Council of the Yorkshire College of Science appointed their Instructor in Weaving, Mr. John Beaumont, to visit the Continent for the purpose of reporting on the weaving and other technical schools of Belgium, Germany, and France, and the Clothworkers' Company of London, by whom the Textile Industries Department of the College was endowed and established, undertook to defray the expenses of the tour. He was accompanied by Mr. Walter S. B. McLaren, of Keighley, and the following detailed Report, giving the result of their inquiries, has been prepared for the information of the Company, who are anxious to gain the best information as to the most effective means of extending and improving Technical Instruction in connection with the Clothworking Industries of Yorkshire and the south-west of England.]

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INTRODUCTION

HAVING been requested by the Council of the Yorkshire College of Science to make a journey on the Continent for the purpose of visiting the weaving and other technical schools of Belgium, Germany, and France, we beg to lay before your Worshipful Company, as patrons and founders of the Textile Industries Department of the College, a Report respecting the various schools we have seen. Knowing it to be the wish of your Worshipful Company that the weaving school of that department should be equal to the best on the Continent, and should be so efficient that it can give a thorough technical education in every branch of weaving to those who attend it, we have endeavoured, in our visit to the continental schools, to notice everything which contributes to their success ; and we hope that the knowledge we have gained may be useful in helping to make the Leeds school such as you would wish it to become.

In the following Report we have not confined ourselves merely to a description of the weaving schools which we visited. The whole system of

secondary and technical education on the Continent, and especially in Germany, is so closely interwoven, that any description of one part without some account of the other would be very imperfect, and an incorrect idea even of that one part would be given. We have therefore referred to some of the other technical schools, and to the German system of secondary education generally. Being convinced, in common with most other persons who have made themselves acquainted with this system, of its completeness and efficiency, we have ventured to give some suggestions as to the way in which, we venture to think, English primary, secondary, and technical education could be so systematised as to approach nearly to the continental system.

We have also given an account of the way in which technical education for girls is provided in Belgium and Germany, knowing the interest which your Worshipful Company has long taken in the higher education of girls, and in the belief that the schools recently opened on the Continent for giving them technical instruction in many trades and in other means of supporting themselves in comfort will meet with your approval.

In the Appendix will be found a list of the weaving schools we visited, and the prospectuses of some of the more important ones.

In our tour of six weeks we visited twenty-four weaving schools, and seven polytechnic schools in which weaving is taught. Some of the schools are exclusively for instruction in weaving, while others are merely departments of larger technical schools, as is the case in Leeds. The greater number of these schools are in Germany, and with the exception of three or four, we visited all we heard of in that country. Possibly there may be others of which we did not hear, but if so, they must be comparatively unimportant. In France and Belgium there are others which we did not visit. Those which we visited, however, are favourable specimens of the whole, and give a correct idea of the general system adopted in such schools. Had it been possible to devote more time to the inquiry, we should no doubt have had a greater number of interesting details to bring under your notice.

REPORT

SCHOOL AT GHENT.

THERE are a considerable number of weaving schools in Belgium, and of these the schools in Ghent and Verviers are considered to be among the best. In Ghent, weaving forms only one branch of a large technical school which numbers more than eight hundred students. The chief subjects taught are drawing in all its branches, mathematics, mechanics, chemistry, natural philosophy, etc. For those who attend the course of textile industry, all the above-mentioned subjects are compulsory, and the course extends over either three or four years, according to the completeness with which the student wishes to study the subjects. For the three years' course, the following is the programme :

First year : Mathematics, natural philosophy, theoretical course of weaving, designing, account-antship.

Second year : Mechanics, chemistry, practical weaving, machine drawing.

Third year : Chemistry, industrial economy, technology, spinning, practical weaving.

The looms belonging to the school are in a "shed," built on purpose for them. Linen appears to be the chief article manufactured on them, though other materials are also used. The school also possesses a number of model steam engines, and other models such as furnaces, gasometers, etc., which are used as illustrations for lectures; and the chemical department of the school appears to be very efficiently managed. All the instruction is free.

"PROFESSIONAL SCHOOL" AT VERVIERS.

The weaving school at Verviers is also a department of the "professional school" of that town. Before 1862 there were in Verviers two schools for artisans; the one founded in 1843 by M. Lambinet, under the name of the "Artizans' School," and the other founded in 1856 by M. Bona, under the name of the "School for Industrial Design and Weaving."

The former taught mathematics, geometry, and mechanics; the latter, as its name implies, taught designing and weaving. In 1862, however, by an order from the Minister of the Interior, the two schools were united, and were formed into one large free evening school for working men. Within the last two years the school has been removed into a new and more convenient building. As it is only needed in the evening for the professional

school, the rooms are used during the day for a secondary school for boys, numbering about three hundred scholars. The evening school has about three hundred and fifty students, and is divided into two sections, viz. the section of mechanics, chemistry, and industrial design ; and the section of weaving and industrial design. The only conditions imposed upon students, who must be more than twelve years of age, are that they shall be able to write correctly, and know the four simple rules of arithmetic. As, however, there may be some who have not even this small amount of education, there is a preparatory course extending over three years for reading, writing, arithmetic, and drawing. For those who are able to take a regular course, which also lasts three years, there is plenty of work. The section for mechanics, chemistry, and industrial design, is divided into two branches—the first for chemists and dyers ; the second for machine constructors. The programme of the first includes algebra, geometry, ornamental and mechanical designing, elements of mechanics, and the construction of buildings, etc., used for the washing and dyeing of wool, the elements of natural philosophy and chemistry as specially applicable to the industries of the town, and the chemical working and preparation and dyeing of wool. The programme of the second branch includes algebra, geometry, ornamental and mechanical designing, natural philosophy as specially applicable to heating of

boilers, furnaces, drying houses, etc., chemistry as applied to the industries of the town ; washing and dyeing of wool ; mechanics, and the construction of machines.

The following is the programme of the section of weaving and industrial design :

First year : Study of looms, natural philosophy, elementary chemistry and algebra, geometry, and industrial design.

Second year : Simple weaving, mechanics, the chemistry of acids, and other common substances, and mechanical and ornamental drawing.

Third year : Composition of textile fabrics, lectures on heating, boilers, etc. ; and the composition of designs after approved principles.

Under the able and energetic directorship of M. Paul Havrez, the school has been in the highest degree successful ; and the combination of subjects in each section has been found beneficial to the students. Those who have attended regularly for three years, and have passed an examination at the end of each year, are entitled to a diploma, to which we shall afterwards refer more particularly. If, however, a person wishes merely to attend one class, such as that of weaving, dyeing, or chemistry (for all of which there are well-fitted-up rooms), he may obtain special permission to do so, and is not entered on the ordinary list of students. There can be no doubt that those who attend the full course are the most far-seeing. As M. Havrez

truly said at the opening of the session of the school several years ago, when addressing the weaving students in particular: "You will yourselves see, later, that the physical sciences, chemistry and mechanics, place at the disposal of those who wish to improve themselves, the general rules which are the result of the experience of past centuries, and which it is not any longer permissible for an overlooker to ignore. All the courses which the programmes and rules have imposed on the students of weaving are of as great utility as the course of weaving itself. It is only after having long examined the utility of these fresh studies, that we have felt obliged to insist upon them as qualifications for the diplomas." "The dyers, weavers, engine minders or stokers, and mechanics of Verviers," said M. Havrez on another occasion, "have henceforth the means of repairing the deficiency in their early education. Provided with scientific principles which alone can safely guide them, our foremen of factories, when anything new is brought out, will no longer grope in the dark, but will know well how to avoid mistakes." This system is not, however, confined to Verviers, but is in operation at Charleroi and other towns, with equally good results.

In addition to these and other similar schools, there are in Belgium apprentice schools, or workshops for apprentices. In many of these weaving is taught. They are managed chiefly by the manu-

facturers of the different towns, who send work to be done in them. The foundation of these schools is said to have been attended with most beneficial results ; but we had not an opportunity of inquiring as fully into the system as we could have wished.

INDUSTRIAL SOCIETIES OF FRANCE.

The French weaving schools are almost always in connection with a large technical school, or an "Industrial Society." There is nothing in this country exactly corresponding to these societies, which are to be found in nearly all the chief towns of France. Their membership is not confined to manufacturers or merchants, but is open to almost anyone who pays the small annual subscription which is required. Each society has its rooms or club house, in which its meetings are held. Papers are read by the members on any subject connected with the object of the society, and a report is issued, in most cases, once a month, containing such papers and other information as the society thinks fit to publish. These reports are circulated, not only among the members of the society which publishes them, but also among all the other similar societies in France. Thus each knows what fresh information any other may have obtained on subjects of common interest. Although these societies are founded by private persons, they, like almost

every other institution on the Continent, receive grants from Government, in addition to the subscriptions of their members. If it can be proved that they are doing good work, they are "recognised to be of public utility by ministerial decree," and receive a grant proportionate to their services. In consequence of these grants, and of the support of the members, every society has classes for instruction in various subjects, which are free to all. In those towns which are engaged in textile manufactures, as is the case with Reims, Rouen, Elbeuf, and Amiens, a weaving school is also opened. The list of classes held by the society for the encouragement of commerce and industry at Rouen is as follows : Commercial law, book-keeping and accountantship, English, German, hygiene, industrial chemistry, heat as applied to industrial arts, designing and ornamentation, theory and composition of ornament, weaving, and modelling. This society also offers a number of valuable prizes for inventions, improved methods of manufacture, and essays on various subjects. To these we shall afterwards refer. In addition, there are two prizes for "high morality," of the value of 20*l.* each, left by the will of M. Dumanoir "in favour of the workman or workwoman, and of the male or female servant recognised as the most deserving in the department." For the benefit of the manufacturers generally, and also of the weaving students, the societies of Reims and Rouen have large col-

lections of patterns of cloth of all materials, arranged systematically in books. At Reims the collection dates back to the year 1800, and is both interesting and useful, as showing the various patterns and materials in use during this century. At Rouen the Society obtains from the Tribunal of Commerce the books containing collections of registered patterns, when the patent-right, which attaches to them in virtue of their registration, has expired. Both societies also add to their collections yearly. The Society of Rouen possesses a good museum containing specimens of all articles manufactured in the Department of the Seine Inférieure. The best weaving schools in connection with these societies are probably those of Reims and Amiens. The latter has recently been much enlarged, and contains about thirty looms of various constructions, besides other machines. M. Gand, the Professor, who is well known for his large and valuable work on weaving, has constructed many diagrams and models for the purpose of assisting his students.

"INDUSTRIAL INSTITUTE" AT LILLE.

The technical schools, which have departments for teaching weaving, are of more recent origin than the industrial societies. The best we visited are the "Industrial, Agricultural, and Commercial Institute of the North of France," situated in Lille, and the "Municipal Professional School" in Reims.

These, as well as others of the same class, such as the "Higher School of Commerce and Industry of Rouen," are among the indirect results of the late war, and are partly intended to compensate for the loss of the school in Mulhouse. They are different from the "Schools of Arts and Trades" which have been established for a considerable number of years. Of these, that at Chalons is perhaps best known. The present "Industrial Institute" in Lille was founded by the department of the North and the municipal authorities; and was opened about two years ago. The former building, which, though really large, is yet, for its purposes, comparatively small, is now used as a higher grade municipal school, to which boys are admitted free on leaving the elementary school, provided they can pass an examination. Evening classes, also free, are held in the same building. There is a similar school for girls in another part of the town.

The Institute has three distinct divisions, namely, the industrial, the agricultural, and the commercial schools. According to the prospectus (a summary of which we append), the object of the Industrial School is to train the heads of establishments, and the directors or foremen of workshops for the principal industries of the North; and it addresses itself especially to those young men, who belong to families engaged in industrial businesses, and who are thus destined for an in-

dustrial career. The object of the Agricultural School is to give to the sons of proprietors and farmers the scientific knowledge necessary to apply to agriculture the most approved methods, and to eventually establish there the so-called agricultural industries, such as sugar making, distilling, etc. The Commercial School is designed to train merchants, bankers, and the higher employees in the great commercial houses and financial establishments. The building, when finished, will form a large quadrangle, three sides of which will be composed of workshops, with a few small classrooms attached, while the fourth side, which is now complete, contains the larger classrooms, lecture theatres and chemical laboratories. Two sides and a half have already been built at a cost of 40,000*l*. The staff of professors will number more than thirty, besides foremen for the spinning, weaving, and dyeing, and for the joiners' and mechanics' shops. The workshops are the most remarkable part of the Institute. Those for mechanics, blacksmiths, and joiners are fitted up with every requisite, and contain lathes, planes, etc., driven by an engine of twenty horse-power. The dyeing department is also elaborately fitted up with hot and cold water, steam, dyeing troughs, furnace, drying machine, etc., and is the most complete of its kind that we have seen. Only a part of the machinery for spinning and weaving has yet been bought; but when this department is in

working order, it will no doubt be equal to the rest of the school. The intention of the Council of Administration is that every student shall become thoroughly familiar with both the theory and the practice of that which he professes to learn, and that on leaving the Institute he may be able to take his place as master or manager in any industrial establishment.

"PROFESSIONAL SCHOOL" AT REIMS.

The Municipal Professional School at Reims also deserves special notice. It has only been open one year, and is intended for boys from thirteen to fifteen years of age, who have attended the public schools of the town and district. During the first two years of their course, all study the same subjects. In the third year, the students are separated into the Industrial, Commercial, and Agricultural divisions, according to the subjects they wish to follow. Some subjects, however, are compulsory for all, such as French literature, English, and German, political economy, and morality, and the laws of health. The weaving school will form an important part of the Industrial division, and a large number of pattern looms have already been bought. As an example of the practical work they propose to do, we may mention that they intend to make a steam engine for themselves, using in the mean time a small one which has been lent them by the town.

At Rouen a similar school on a smaller scale has recently been founded. It has also a department for weaving, which has been fairly successful, considering the short time it has been open. In the south of France—in Lyons and Nismes—there are also weaving schools, but these we did not visit. They are almost entirely for silk and velvet. Throughout the whole of that country, we were told, there is a movement in favour of technical education, and among the subjects which, it is generally agreed, must be taught, theoretically and practically, in schools, weaving takes a leading place.

GERMAN "TRADE SCHOOLS."

In Germany technical education is much more fully developed than in either France or Belgium. In addition to the "Gymnasium" and "Real Schule," or literary second grade school, and practical or scientific second grade school, to which our higher schools very imperfectly correspond, every town has its "Gewerbe Schule," or Trade School, which gives a somewhat more practical education than even the Real Schule. Those who attend the Gewerbe Schule usually go into business after leaving it, but the "Real Schule" and "Gymnasium" are considered preparatory to the Polytechnic and University respectively. In the manufacturing towns the real and gewerbe schulen are the most prominent, the latter perhaps taking the

lead. In Elberfeld a new gewerbe schule has just been built at a cost of about 20,000 \textcent , including all the fittings. At Barmen, about twelve years ago, a similar school was erected at a cost of 15,000 \textcent . Its programme comprises religion (Protestant), German, English, French, history, geography, accountantship, writing, algebra, geometry, higher mathematics, land surveying, mechanics, knowledge of machines, building-construction, natural philosophy, chemistry (both practical and theoretical), mineralogy, botany, zoology, free-hand drawing, linear drawing, and singing. It has about four hundred students. The programme at Elberfeld is much the same. The school has about four hundred and fifty day students, and about one hundred and twenty night students, who learn chiefly drawing.

At Chemnitz a new gewerbe schule is nearly completed, which puts all others into the background. Its cost will be more than 80,000 \textcent , and it will accommodate between six and seven hundred students. Its staff of professors will number about forty. A chemical and physical laboratory, divided into six departments, each for twenty-four students and a teacher, forms one large portion of the building, and is fitted up with every appliance requisite for teaching chemistry and physics. The school possesses a library of nine thousand volumes, upon which is spent 300 \textcent a year, out of an annual grant of 7000 \textcent from Government.

At the time of our visit, three of the professors were travelling at the expense of the school; one of them had been sent to the Brussels Exhibition, the other two were in London. Among the officials is a draughtsman, whose duty it is to be constantly travelling to see new machinery of every sort, and to make large diagrams of what he thinks will be of use to the students. The result is that the school possesses a large and valuable collection of drawings of most of the principal machines in use, which are available for the students who study machine construction. The programme is very similar to that at Barmen, but more stress is laid on chemistry and natural philosophy, and on building, than in that town.

In Berlin there is a "Gewerbe Akademie," which is similar in many respects to a polytechnic school. The highest branches of the same subjects are taught in it; and, as in all the other technical schools, drawing forms an important feature in the system. It has forty professors and from seven to eight hundred students, who come from all parts of Prussia and Germany. In each of the thirteen provinces of Prussia there are eight free scholarships to the Academy, which are competed for by the students of the real and gewerbe schulen. The Academy receives eighteen thalers (2*l.* 14*s.*) per month from the State for each free student. The chief feature in the Academy is the collection of

models of spinning machinery, looms, etc., to which we shall afterwards more particularly refer. Lectures on the theory of spinning, weaving, etc., are given four hours a week, and are illustrated by these models.

SCHOOLS IN VIENNA.

Vienna possesses a complete system of secondary schools, which varies slightly from the Prussian and German system. The terms *Real Schule* and *Gewerbe Schule* do not mean the same thing in Austria as they do in Germany. In the latter country the two schools are distinct, and both are for day students, though in some cases night classes are also held. In Austria, however, the same building is both a real and gewerbe schule, being used for the former during the day-time, when the students pay a small fee ; and for the latter in the evenings from 6.30 to 9.30, and on Sunday mornings from 8 to 12, when all the students are admitted without charge. Each ward of the town has either an upper or a lower real schule, supported by the municipality. The best of these is probably that in the ward of Wieden, which has six hundred day and three hundred evening students. There are also two Imperial Upper Real schools. The newest and best, which is in Leopold-Stadt, has been erected at a cost of nearly 75,000*l.*, and is fitted up apparently regardless of expense. It has eight

hundred day scholars, who pay about 3*l.* 10*s.* a year, and three hundred free evening students. In these schools chemistry, natural philosophy, mathematics, and drawing, seem to be the most important subjects. The apprentice law is peculiarly favourable to night classes in Vienna, as every apprentice is compelled to attend an evening school for at least one year of his apprenticeship. As an example of the work done by them, we may mention that we saw a number of the drawings by the students, among which was a large and elaborate design for a stained-glass church window, drawn by a young man who was apprenticed to the trade of glass painting. With such a system in operation, it will not excite surprise that the Viennese should have obtained a high reputation for making ornamental fancy articles.

POLYTECHNIC SCHOOLS.

Besides all these schools, Germany and Austria are famous for their polytechnic schools, which may be called technical universities. Nearly every important town possesses one. At Aix-la-Chapelle the polytechnic school was built only six years ago ; but so great has been its success, that though it is very large, and complete in every respect, another building of equal size is being erected by its side, which is to form the chemical department, while that part which is now used for chemistry will be made into a museum, or kept for additional

classrooms. At present there are more than five hundred students, with twenty-four professors and eighteen assistants. The subjects taught are comprised under the heads of architecture, engineering, land surveying, technical knowledge of machines, chemistry, and metal working. Each department has collections of apparatus or models for illustrating lectures ; among these the collection of geological specimens is particularly good. We noticed a number of packing cases, which we were told contained models of English patent machines, sent as a present by the British Government at the request of the Prince Imperial of Germany. If this be really so, and we have no reason to doubt the accuracy of our informant, we would suggest that the Government should be invited to extend its liberality to the College of Science and other similar institutions in their own country.

The town of Hanover possesses a polytechnic, as do also all the capitals of the South German States. At Dresden a new and large school has been built. That at Carlsruhe is well known as one of the best in Germany, while at Stuttgart there is not only a large and well-organised polytechnic, but also a building school of almost equal size. The students at the polytechnic number over five hundred. In winter about nine hundred workmen, such as masons, joiners, engineers, etc., attend the building school, but in summer the numbers are greatly reduced ; as nearly all the students are

obliged to work for their living. One of the most noteworthy features of the Stuttgart Polytechnic is the system of taking the students excursions during the holidays. For example, last year during the holidays, from the 3rd to the 13th of June, one of the professors of architecture took his students to Bruchsal, Heidelberg, Mainz, Bonn, Cologne, and several other towns, to study examples of the different styles of architecture. In the department of engineering there were a number of short excursions, some of which were to see the building of a railway station. Another excursion in the machine-making department was to Schaffhausen, and the St. Gothard tunnel. In the department of mechanical technology excursions were made to many of the surrounding towns where any manufacture is carried on; and in those of mathematics, natural history, and botany, a great number of excursions were made to various places. These no doubt would be of great practical value to the students, as their professors would be able to point out and explain many things which would otherwise have escaped their notice.

In Bavaria there were formerly three polytechnic schools—at Munich, Augsburg, and Nurnberg. The two latter have recently been reduced to the rank of industrial schools, and the number of their students has somewhat fallen off. The school at Augsburg, however, still retains a very good workshop fitted up with lathes, planes, etc., for metal

work, and driven by steam power. Attendance in the workshop is compulsory for all students in the mechanical department. Although the Augsburg and Nurnberg schools have somewhat fallen off, that at Munich has greatly increased, till now it has scarcely a rival in the German empire. Every department has a good museum connected with it, and to this great importance is always attached, as it is considered that the students can learn best by having before them specimens or models of anything upon which the professor may be lecturing. A weaving school is to be added to this polytechnic. The machinery is to be driven by steam power, and it is expected that the school will be one of the best in Germany.

In the chief towns of Austria the polytechnic schools occupy the same position as they do in Germany. In Prague there are two, one for German students, the other for Bohemians. This division has only recently been made, but was found necessary owing chiefly to the objection of the Bohemians to be taught in German. The best polytechnic in Austria is undoubtedly that of Vienna. Until the death of the late ex-emperor the school was patronised by him, and owes much to his generosity. The textile industries department of its museum is very complete, as it contains specimens of almost every manufactured article in its various stages, from the raw material up to the finished piece of goods. It also possessed a con-

siderable number of looms, some of full size ; others models, which are used by one of the professors, who lectures three days a week on the theory of spinning and weaving. Every other department of the school has an equally good museum ; for it appears to be an acknowledged principle in German education, that for all the higher branches of scientific and technical education, museums and laboratories or workshops are indispensable. So great is the success of this school that it has forty-two professors and one thousand two hundred students.

Any account of the continental polytechnic schools which did not include that of Zurich would be very imperfect. It is well known as one of the best and largest. It joins, and may be said to form part of the same building as the university ; and thus has the advantage of sharing with the latter its great collections of geological and zoological specimens, and of mechanical models. It has about seven hundred and fifty students, some of whom are ladies ; for the polytechnic, in common with the university, opens its doors to all those of the required age (seventeen) who can produce a certificate of good conduct, and who pay the annual fee of about 4*l*. The admission of women, however, is not a peculiarity of Zurich, for most of the continental universities are open to women on the same terms as to men. A weaving school is to be opened at Zurich in about a year, chiefly for

the benefit of the silk trade ; but the polytechnic already possesses, in the technological museum, a few looms, and parts of other machinery, connected with textile manufactures. Perhaps the most remarkable of their museums is that belonging to the mechanical department. Besides other things, it contains an astonishing number of models illustrating the motions of eccentric wheels of every form, which are studied by those students interested in engineering and mechanics.

COLLECTIONS OF MODELS OF MACHINERY.

Of all the museums which we visited, however, those of the Gewerbe Akademie in Berlin, and of the Conservatoire des Arts et Metiers in Paris, were of greatest interest to us in connection with the main object of our journey. The former contains models of almost every machine used in either the cotton or woollen trade. Not only are there models of machines now in use, but also of machines which have long since been superseded. Thus, for instance, there are models of cloth-finishing machines such as are used now, and also of the very antiquated method of finishing the cloth by means of large horizontal shears. The advantage of this great variety is, that the students see what have been the improvements gradually made in machinery ; and it enables them to study the principles on which the different machines have

been worked. Berlin has a large collection of preparing and spinning machinery. In the Conservatoire in Paris nearly all the models are those of looms. The Conservatoire corresponds, to some extent, to the German polytechnics, but differs from them in two important respects. All the instruction is free, and is given in lectures, which anyone may attend. There is thus none of that class work, and discipline, which are found in a polytechnic; nor would it be possible to have it, as many of those who attend the lectures are adults, and are engaged in various industrial and other trades. There is no practical work, such as there is in most of the polytechnics: those who attend the lectures may be described as an audience, rather than as students. The museums for all the branches of instruction are very complete. They include electrical apparatus, and instruments for every branch of natural philosophy, of agriculture, mechanics, textile manufactures, etc. The last-named department is specially rich in its collection of looms. There are models of looms of every construction from the very earliest times; illustrating the growth of the art of fancy weaving. There are even a few Indian and Chinese looms, of the most elementary kind, which show the original form of looms. Nearly all the models, even of the earliest looms, have been made within the last thirty years, and the collection is evidently chiefly of recent date. The weak point about the teaching

of weaving in both these institutions is, that the students do no practical work. In the Conservatoire, however, the objection is partly removed by the fact that those most likely to attend the lectures have acquired some knowledge of weaving. In the Akademie of Berlin the lectures are chiefly on the construction of the machinery, with exercises on the planning of machines. These machines form only a small part of the department of machine construction and engineering, but for the purpose for which they are intended, they are probably sufficient. It is in this way that weaving is generally taught in the polytechnic schools. They have not a department for weaving in the same way as the Industrial Institute of Lille; but the theory of weaving and the construction of machinery are taught as a branch of the larger department of machine construction.

WEAVING SCHOOLS.

The system of technical education in Germany is not, however, confined to the semi-practical work of the polytechnic and gewerbe schule. For each of the most important industries there are special technical schools, to which students can go who are not able to afford the time required at the polytechnic, or who for any other reason do not wish to complete their studies there. The chief of these are for farming, gardening, forestry, mining,

building, and weaving. As might be expected, the weaving schools of Germany vary greatly in almost every respect. It would be difficult to say that any one has a decided superiority over all the others. The best, however, are those of Chemnitz in Saxony, Mülheim on the Rhine, Crefeld in Westphalia, Reutlingen in Wurtemberg, and Grünberg in Silesia. The school at Mulhouse in Alsace is one of the best known. Before the war it was very prosperous, and students from all countries came to it. Now it is much reduced ; fewer students come to it ; and, as the Society of Manufacturers by whom it is supported are strongly opposed to the German Government of Alsace, no German students are admitted. It seems doubtful whether it will recover its former position.

METHOD OF FOUNDING THESE SCHOOLS.

In nearly every case these schools have been founded by the Government and the municipal or other local authorities of the town in which they are situated. Sometimes the manufacturers of the town have been the originators of the school, and generally they help to support and manage it. In Grünberg the school was built in 1864 by the Government and the magistrates, and is under the management of a committee of fifteen, among whom are the chief manufacturers of the town. In Mülheim the school is supported by the State, the burgomaster being chairman of the committee

of management. The school at Einbeck, in the province of Hanover, is under the direction of the Trade Association for Hanover. In Saxony the manufacturers take a leading part in managing and supporting the schools. The present large and handsome school in Chemnitz was built in 1857 by the Saxon Government and the Town Council. It is under the direction of members of the Town Council, the manufacturers of the town, and the director of the *gewerbe schule*. In Meerane, in the west of Saxony, the school has recently been greatly enlarged by the local manufacturers. At Gross-Schönau, near Zittau, in the east of Saxony, there is also a weaving school, which was founded by subscriptions from the manufacturers in the neighbourhood. Like almost all the other schools, it does not pay its own expenses, and is supported by the Government, the local authorities, and by private subscriptions. The subscribers meet every three years to elect a committee of management. In Wurtemberg and Bavaria the weaving schools are more purely Government institutions. That in Reutlingen was founded in 1855 by the Minister of Trade and Commerce, and is still under his supervision, though managed by a local directorate. The same is the case with the school at Heidenheim, founded eleven years ago. The Government appears to have thought that a weaving school would improve the manufactures of the district, and therefore established one in this beautifully

situated little town. As no suitable building was at liberty, they placed the school in two large rooms of an old ruined castle which overlooks the town, and fitted up a few other rooms which were habitable for the teachers. This interesting union of the ancient and modern is to be destroyed, as a large new school has just been built, at the joint expense of the Government, the town, and the surrounding district. The weaving school of Passau, in Bavaria, is chiefly supported by the Government. That which is to be opened at Munich will be under the same management as the rest of the polytechnic school. In Vienna the weaving school is under the management of the Gewerbe Schule Commission. It is not, however, a large school, and not equal to the best German schools before mentioned. In Prague there was formerly a class for teaching weaving in connection with the gewerbe schule, but it has been suspended for the present, as the room in which it was held was needed for other purposes. The only weaving schools in Germany, so far as we could learn, which are exceptions to the general rule of receiving State aid, are those of Mulhouse and Barmen. The former belongs to a society of manufacturers, who make good any loss there may be in working it. The latter is in the building of the Art and Trade Society of the town, and is supported by them. This society corresponds very nearly to an English mechanics' institute. It possesses a handsome building, erected at a cost of

5000*l*. Its members, who number five hundred and fifty, belong to all classes in the town. The annual subscription is 15*s*. They have the ordinary club-rooms for members, and several large classrooms in which drawing is taught, besides the weaving school. These classes are meant chiefly for working men, and are similar to the classes of our mechanics' institutes. The only weaving school which has been permanently closed is that of Elberfeld. Several reasons were given to us for this. The most probable was that the school got into bad order, and students ceased to come to it in sufficient numbers to make it desirable to keep it up. As a general rule, the schools seem in a prosperous condition, and in most cases the number of students is increasing.

SIZE OF THE SCHOOLS.

The size of the schools varies very much. In the school at Chemnitz there are fifty-four looms, of which twelve are worked by steam power. In Reutlingen there will soon be seventy, of which twenty-four will be power-looms. In that at Mülheim there are thirty looms; in Crefeld eighteen, and in Barmen twenty-four. This last-named school is only open on Sundays and Mondays. In Mulhouse there are twenty-four looms, all driven by steam power. In Gross-Schönau there are twenty-eight looms, only two of which are worked

by power ; in Heidenheim there are about twenty-four, in Passau sixteen, and in Vienna only eleven.

With the exception of Mulhouse, all the schools prefer hand-looms. The best, however, have also power-looms, which are undoubtedly useful for giving the students greater experience, and teaching them the construction of different kinds of looms ; but we do not regard them as indispensable. With them there is a tendency to weave long webs, which is a waste of time ; besides which, a student is more likely to understand the principle on which a pattern is woven when it is done by hand. The expense of working power-looms is also greater, and renders the sale of the article woven upon them almost necessary to help to defray the cost. The best schools, Chemnitz and Reutlingen for example, have a great variety of hand-looms, such as treadles, machines, and jacquards, in order to produce patterns, simple and figured, in every material. The looms, however, are not full-sized in all cases. It seems to be desirable to have a few large looms of different constructions, both to teach the students how to work them and to give them some experience in weaving large patterns. But in those schools where the designing and weaving of patterns is best taught, most of the looms are simply for weaving samples, or narrow pieces. As regards this point, the best schools may be divided into two classes—those which only weave patterns, and thus allow the

students frequently to change their designs—and those which weave short pieces, and have a sufficient number of looms to allow the students to see a variety of patterns and materials, without altering the looms so often. The former method is adopted at Grünberg, and to some extent at Mülheim and Chemnitz. The latter is adopted at Barmen and Crefeld. The former appears decidedly the better one, as it gives the students more practice in arranging their looms for new patterns which they have designed. By the latter they merely become acquainted with the way in which the patterns are woven, and have not the opportunity of weaving their own designs as often as is desirable. A third plan, which is adopted at Mulhouse, Reutlingen, and other schools, is to weave long webs. This seems to have no merit but that of greater economy, and is condemned by those who have tried the other methods. Where a school has only a few power-looms and a large number of hand-looms, there does not seem to be the same objection to using the former for weaving long pieces, because after each student has had only a short turn at the loom the piece will be finished. To weave long pieces on hand-looms appears a very undesirable process in a school.

The system adopted depends, in nearly every case, upon the way in which the raw material is obtained, and the use which is made of the woven article. In Grünberg the material is bought by

the school and given to the students ; the patterns they have woven belong to the school when the students leave, and serve as examples for analysis for the next year, along with fresh patterns which are constantly being bought. At Chemnitz and Mülheim the students pay for materials, and keep the pieces they have woven. An entirely different plan is followed at Mulhouse. Cotton is chiefly used there. It is bought in the raw state and spun in the school. As much of the yarn as is needed is used for weaving, and the remainder is sold. If any silk or worsted yarn is needed it is bought ready made. The pieces are all sold, and help to defray the expenses of the school. As nothing is paid to the students for wages, they can generally sell the pieces at cost price, notwithstanding any faults there may be in the weaving. In Reutlingen there are three divisions of students. The first have almost entirely theoretical work, and are in the school eight hours a day. The second weave entirely on hand-loom, and work twelve hours a day. They are paid for their work, although they pay a fee to be taught ; and if there are faults in their work, they are liable to deductions from what they have earned. The third division weave entirely on power-loom. They must either know how to weave before they come to the school, or have passed through the first or second division. The students of both the second and third divisions weave long webs, which are sold by the school.

At Gross-Schönau and Passau manufacturers send material to be woven by the students, and receive it back when finished. In Heidenheim a rather curious plan has been adopted. The teacher buys a certain amount of material, which is made into cloth under his directions. He then takes the patterns thus made to the various manufacturers and endeavours to sell them. If the manufacturers buy the patterns, they pay him back for what he has laid out, and send him material, which the students weave into pieces of the same pattern as that he has sold. The finished article is then sent to the manufacturer. In this way the material costs nothing to the school. It is plain, however, that by these methods the students have to weave not only long webs, but also whatever patterns and materials the manufacturers may happen to want. It must, however, be far more satisfactory to the student to have all sorts of materials, and to be able to weave any pattern, which he can do in those schools that adopt the system of weaving only samples.

ALL CLASSES OF GOODS WOVEN.

None of the schools confine their teaching to the manufacture of only one class of goods. Although each devotes most attention to the material and style of cloth which is chiefly manufactured in the district in which it is situated, yet

all teach other branches of weaving. In the largest and best managed schools, the greatest variety of material is generally found. The teachers and students seem to be free from the idea, too prevalent here, that it is only necessary to learn that branch of weaving which is immediately connected with the particular trade the student intends to follow, or which is the chief trade of the district. It is generally recognised that to become thoroughly master of the art of weaving, the student must be familiar with every branch of it, even though he may only intend to manufacture one class of goods in after years. In consequence of his wider study, he is able to bring into his own trade the ideas and patterns of others ; and thus can produce a greater variety of designs than his neighbour who has only studied the manufacture of one class of material. At Chemnitz, for example, where the chief manufacture of the town is worsted goods, the weaving and designing of worsted, woollen, cotton, silk, and linen is taught. At Crefeld, where silk is largely manufactured, there are also looms for woollen cloth, worsted and cotton fancy table-covers, velvet, ribbons, figured silk, and one for carpets. In Barmen the material in the looms included plain and figured cotton cloth, small woollen shawls, table covers of cotton and worsted mixed, velvet, silk, ribbons, fancy designs for book-marks, woollen fringe, worsted

braid, etc. They have also two machines for making tape. In Reutlingen, cotton and linen weaving are chiefly taught ; but there are several looms for woollen and silk. In Grünberg, where woollen goods are made, the school also teaches the manufacture of other materials. So it is in every school, with scarcely an exception. In those schools which give most attention to silk and linen, the patterns are very elaborate. At Barmen, for example, one loom was weaving a picture of a monument erected in memory of those who fell in the late war. This design, which contained more than two hundred picks per inch, was very perfect. At Mülheim the students appear to be fond of weaving for themselves calling cards, and little pictures in silk. Some of the designs for linen tablecloths at Heidenheim, Passau, etc., were very elaborate. It does not follow, however, that in these schools the best work is being done, as it may be more difficult to analyse or arrange for weaving a piece of woollen cloth of unpretentious appearance.

DIVISION OF TIME.

The method of teaching is very similar in all the schools, and is much the same as that adopted in the weaving department of the Yorkshire College of Science. In Chemnitz the students work thirty-

eight hours a week. Their time is divided as follows :

	First Half-year.	Second Half-year.
	Hours per week.	Hours per week.
Analysis, etc., of patterns ..	16	12
Composition of patterns	2	2
Theory of hand-weaving	4	2
Theory of power-loom weaving ..	4	8
Practical weaving	8	8
Drawing	4	4

In Crefeld the time is thus divided :

	Hours per week.
Theoretical teaching of weaving	4
Preparation of drafts	12
Free-hand drawing	4
Practical weaving, or Technical teaching (analysis, etc.) }	24

The practical weaving is taken alternately with the analysis, etc., so that after the students have been studying the analysis of a certain class of goods they may have some practical experience in weaving them. All students are taught to prepare and cut their cards for the jacquard looms. In the other schools the arrangements are somewhat similar. The chief exceptions are Reutlingen, Mülheim, and Vienna. In Reutlingen, as previously stated, there are three divisions. The first division is almost entirely confined to theoretical work ; the second has only five hours of theoretical work, the rest of the time being occupied at the hand-loom ; the third division is confined to power-

loom weaving. These three divisions are quite distinct from each other, and the students do not appear to pass from one to the other. The first division is intended chiefly for the sons of manufacturers and merchants, and the second and third divisions for those who are to be overlookers, etc. This plan, however, does not seem a good one, as the one division gets too little practical work, and the other two get too much. In Mülheim more attention is paid to drawing. As the prospectus of the school states, "drawing is of the utmost importance in the division of figured weaving, as the scholar, by a thorough knowledge of it, is enabled to invent new designs, and also to put them into a suitable form to be practically carried out." This instruction is divided into two parts: 1. Free-hand drawing, consisting of drawing from copies, plaster models, and from nature, such as flowers, etc. 2. Instruction in the drawing of designs for practical weaving. In Vienna great importance is also attached to drawing. The instruction there is divided into two parts, the first for weaving, and the second for drawing, in connection with manufacturing. The former subject is taught in the forenoons of Mondays, Wednesdays, and Fridays, and the latter in the forenoons of Tuesdays, Thursdays, and Saturdays. Work is given out for the students to do at home in the afternoons. On Sunday mornings and Monday evenings both divisions are open for the benefit of

those engaged in business at other times. Mechanical, as well as free-hand drawing, is taught, and the work, specimens of which we saw, is well done.

SPINNING AND DYEING TAUGHT.

Book-keeping is taught in some of the schools. In Crefeld the system comprises five books—for the raw material, weft, warp, weaving, with the cost of the finished article, and dyeing. In Grünberg, Passau, and some other places, the students attend a different school for instruction in those branches of chemistry which are connected with manufacturing. Two or three hours a week are devoted to this purpose.

Besides weaving, spinning is taught in some of the schools. In Mulhouse, however, spinning is taught practically, as the school possesses a set of cotton carding and drawing machinery, with two mules of two hundred spindles each. On these all the cotton yarn they use is spun, and what is not used is sold. Had not the Franco-German war taken place, the school would have been greatly enlarged, and would have been, in fact, a small mill, as all the machinery is worked by power. The school at Einbeck, in Hanover, has the advantage of adjoining a small spinning mill, the owner of which is also director of the school. He allows any students who wish to learn spinning to spend part of their time in his mill, and learn all they

can. As he dyes most of his wool before spinning it, they also learn something of dyeing.

In all the schools some instruction is given respecting the raw material, and the way in which it must be treated. Such instruction is, however, merely theoretical, and is illustrated by samples of material from the raw state up to the yarn. In some cases there are a few models of preparing and spinning machinery, or of portions of the machines.

Dyeing is taught at Mülheim, and in this respect it is the most complete of the German schools. Attached to the weaving school is a dye-house, fitted up with all the necessary appliances, and also a laboratory and classroom. Under the direction of a chemist and a dyer, "instruction is given in the theoretical relations of the combined dyes, and also in their preparation and practical application." The students are thus able to dye the yarn which they wish to weave, to any colour that their design may require; and they can tell by the result whether or not their pattern is in good taste. Besides this, they learn, of course, the effect of the different dyes upon the material, how each should be treated, and how fresh colours or shades can be made. In those schools where the students learn chemistry, some knowledge of dyeing is also obtained, but not in such a thorough way as at Mülheim.

COLLECTION OF PATTERNS.

There is another point upon which much stress is very properly laid, viz. the collection of patterns of all materials. It is considered that when the students have access to such collections it educates their taste, and shows them what has been made in former years, and what styles have been most in fashion. They are also able to see the gradual improvement which has taken place in all classes of manufactured goods, and they are helped in their first attempts at designing by getting ideas from the patterns which are before them. One of the best collections is that belonging to the school at Barmen, which consists chiefly of silk damask. At Grünberg there are a great number of patterns, and all the other schools have collections to a larger or smaller extent. Besides patterns, some of the schools possess small libraries of works on weaving, designing, and drawing. That of Vienna has more than one hundred volumes, which are added to yearly, by presents from the Minister of Commerce and the Gewerbe Schule Commission. There are several periodicals on the subject of weaving, which are taken in by some schools. The chief of these are *Das Deutsche Wollen Gewerbe*, and *Das Centralblatt für die Textil Industrie*, both published in German. *Le Jacquard*, and *Les Tissus*, are French periodicals, published at

Elbeuf, and *L'Ornement des Tissus* is published in Paris. *Les Tissus* is published also in English, German, and Italian. It is devoted entirely to the explanation of new designs in cloth which are prepared by M. Bertin, the editor, and his assistants. Samples of the cloth are sent along with the journal, and would in a few years form a good collection of Elbeuf goods.

To give the students some further insight into the practical management of factories, they are in many cases allowed by the manufacturers of the town to visit their mills on stated days. This is undoubtedly a great advantage to the students, for it shows them on a large scale, and from a business point of view, those things which they are doing on a small scale. If during these visits the students are allowed to spend sufficient time in the mills to see thoroughly what is being done, and to become familiar with the different processes through which the material passes, the weak point of the weaving school is removed; which is, that although the student may get a thorough theoretical training, he does not become familiar with the practical part of the work, in the same way that he would if he were in a mill. In any case, however, if after leaving the school he goes to a mill, either as an apprentice or a manager, the theoretical knowledge he has obtained enables him much sooner to grasp all the details of the mill work than if he had gone without that preparation.

THE NUMBER OF STUDENTS AND TEACHERS.

The number of the students and the amount of the fees vary in every school, and appear to be regulated according to the social position of the students it is desired to attract. The number of teachers appears large in proportion to the students. In Mülheim there are four teachers for weaving and two for dyeing. The students number about sixty, and pay 15*l.* a year, with 3*l.* for materials. In Crefeld there are three masters, and forty students who pay 6*l.* each. In Barmen there are seventy, who come only on Sunday mornings, and pay 1*s.* 6*d.* a quarter; and about twelve on Mondays, at 9*s.* a quarter. There are three masters for weaving and four for drawing. At Chemnitz there are five masters for weaving and designing, and forty students, the fee being 13*l.* 10*s.*; and 4*l.* 10*s.* for materials. At Meerane about one hundred students come on Sunday mornings, and week day evenings, for the small sum of threepence a month; and they are taught by four masters. At Gross-Schönau there are eighteen students at 2*l.* 5*s.*, and three masters. At Grünberg the fee is 9*l.*; there are thirty-six students, and three masters. During the twelve years this school has been open, there have passed through it two hundred and fifty students. In Vienna about twelve come on week days, and sixty on Sundays; there are two masters,

and the instruction is free to all. In Reutlingen there are four masters, and about forty-five students. The first division pay 6*l.* 10*s.* for a course lasting six months, and are charged extra for materials. The second division pay 3*l.* for a one year's course, and are paid for their work. The third division pay 4*l.* 10*s.* for a course of six months. Mulhouse formerly had forty students paying 24*l.*, but last year it had only fifteen ; it has five masters. At Einbeck there are two masters, and about twelve students paying 7*l.* 10*s.* each. Heidenheim has ten students at 2*l.* 10*s.*, and one master.

The head master of each school, or, as he is called, the director, nearly always lives at the school. He teaches the theory of weaving, and has masters under him who help the students while they are working at the looms. In some cases the director teaches drawing ; but if not, it is taught either by one of the ordinary masters, or by a special master who is engaged for the purpose. Some of the under masters are merely skilled workmen, who see to the preparing of the material, etc., in order that the time of the students may not be unnecessarily taken up with work from which they can learn nothing. A glance at the fees shows pretty clearly the social position of the students at each school. At Mulhouse, Chemnitz, and Mülheim, for example, only the sons of manufacturers and merchants can afford to become students. At

Reutlingen the first division is intended for those of the richer class, while the second and third divisions are within the reach of working men. At Heidenheim and Gross-Schönau the fees are low enough to be within the reach of all. At the latter place most of the students are boys who come immediately after leaving school. At Meerane and Barmen the schools are chiefly attended by working men and their sons. The school at Vienna, like the schools of the industrial societies of France, is free, and is taken advantage of largely by artizans. Wherever the fees are low enough, the working men take advantage of the schools, and are thus made into skilful workmen and overlookers. The low fees do not drive away the sons of manufacturers, and the schools which are within the reach of all are, therefore, much more popular and useful than those which, from the larger fees charged, are more exclusive.

SCHOLARSHIPS AND DIPLOMAS.

Where the Government is the chief supporter of the school, a certain number of students are generally admitted free, after passing an examination held either by the managers of the weaving school or of some other school which the student may have attended. The Trade Association of Hanover offers a certain number of scholarships, of 7*l.* 10*s.*, to students who attend the school at

Einbeck. The grant appears to depend on their passing examinations in weaving during their course of study. In Chemnitz, a few of the manufacturers send free students to their school. Some of the schools, that of Mulhouse for example, grant certificates of proficiency in weaving to the students who, at the end of their course, are able to pass an examination. The system of granting diplomas and travelling bursaries, which is in operation at Verviers, is better arranged, and more successful than any other we heard of. As before stated, all those who have attended the school for three years, and passed an examination at the end of each year, are entitled to a diploma. Those who have passed highest in the third year, and have gained more than 75 per cent. of the total number of marks, receive also a gold medal. If any one has acquitted himself with sufficient distinction, he receives a travelling scholarship, which enables him to visit other countries, and become acquainted with their industries. On his return home, he has to give an account of what he has seen, and the progress of the special industries he has visited. The three diplomas given are those of "Chemical Dyer," "Mechanical Constructor," and "Master Weaver." From 1864 to 1870 inclusive, twenty-nine diplomas of Master Weaver were granted. The diplomas are of different grades, according to the manner in which the examinations have been passed. They are severally

marked, "satisfactory," "with distinction," "with distinction and great success," accompanied by a medal ; and "with great distinction," accompanied by a medal and travelling scholarship. Only one scholarship and two medals had been awarded up to 1870. That these diplomas represent a considerable amount of useful knowledge, and are valued accordingly, is evident from the fact that the holders can obtain higher wages, and more regular work, than their fellow workmen.

PRIZES AT ROUEN.

In Rouen, as before mentioned, the Society for the Encouragement of Commerce and Industry gives a number of prizes for inventions, improvements in the method of treating articles of manufacture, and essays or other original works on literature, fine arts, and political economy. Their programme for the next three years divides the prizes into four classes. First, that of physical and natural sciences, in which fourteen prizes are offered of the total value of about 380*l*. This includes such subjects as the invention of a thermometer registering from 100° to 500° centigrade ; the carbonisation of wood ; the action of hot air on metals ; the extraction of sulphur from sulphates and natural sulphurets, under such conditions as would allow the product to be sold at the same price as Sicilian sulphur ; the best

apparatus for combining the heating and ventilation of public buildings; and other subjects of the same nature. The second section is for literature and fine arts, in which there are nine prizes of the value of 220*l*. Such subjects as a memoir of Nicolas Mesnager, negociator of the peace of Utrecht, who was born at Rouen; and an essay on the arts of Normandy since the period of the Renaissance, are prescribed for competition. In the third section, that of economy and commerce, there are five prizes of the value of 140*l*., and nine medals of honour. The subjects are such as the following: The best elementary treatise on the principles which regulate the circulation of money; the best plan for workmen's houses; for statistical researches into the working class population of Rouen, their history, condition, and the means of improving it. A medal of honour to the first commercial house established in China, Japan, Australia, or English India which can prove that in one year it has sold produce to the amount of 100,000 francs coming from the industries of the Seine-Inférieure; and that, too, at a remunerative price, which will allow the business to be carried on. A gold medal, stamped with the name of the gainer, has been founded, from 1872 to 1877, to be given to any person who has introduced or developed a new industry in the Department. The fourth section is that of mechanics and industry. There are seventeen prizes of the value

of 360*l.*, and nine medals. The subjects chiefly relate to the improvement of the means of carrying on manufactories. They are such as the following : For a new system of economically heating boilers ; for a new process of preventing deposits in boilers ; for a smoke-consuming apparatus easily applied to ordinary furnaces ; for a treatise on the affinities which different species of wool and cotton have for dyes ; for the best treatise on the construction of industrial buildings ; a gold medal for the firm which has most completely applied to its machinery, guards for the prevention of accidents, and whose premises are best heated and ventilated. Such a system of prizes and medals of honour cannot but be an inducement to the manufacturers and workmen of the department to study the subjects given out for competition, and to invent the necessary machines, and write the proposed essays. It is not likely that all the prizes will be awarded ; but whether they are or not, those who compete for them will have been benefited by the study they must give to the various subjects.

OBJECT OF WEAVING SCHOOLS.

The object of weaving schools is much misunderstood in this country. In the minds of many persons there is an idea that they are simply meant to teach workmen the management of a

loom. This is entirely a mistake, for while power-loom weaving is everywhere supplanting hand-loom weaving, in the business of manufacturing, only hand-loom are essential in a weaving school. Nor is the object of the school solely to teach the actual weaver, but also to teach the masters and overlookers, or those who expect to occupy such positions. It is hardly necessary to say that any weaver who could attend a weaving school for a course of six months or a year, would, at once, cease to be a common weaver, and could obtain a situation as an overlooker, at a higher salary, with the greatest ease. As the prospectus of the Mülheim school states, the school "devotes itself to the task of educating overseers and manufacturers in all branches of weaving, and furnishing young men who wish to become buyers or sellers of manufactured goods with an exact knowledge of manufacturing, and thereby with a correct judgment of goods."

Another objection is often made, which is much more plausible, and is to this effect: "If a young man wants to learn weaving, let him go to a first-rate mill. He will there see every department of the business in the highest state of efficiency, and managed by skilled men who are able to teach him whatever he wants to know. He will see the newest patterns and the best machinery, and will get an insight into the general management of the business which he could not obtain at a school."

There is certainly some truth in this ; but the answer is, that the weaving school is not meant to supplant the training received in the mill, but to supplement it in that particular where the latter fails. The proper management of a mill can only be learnt in a mill. The apprentice in a mill will probably see newer patterns than he can see in the weaving school ; that is to say, he will see other men designing and arranging new patterns ; but will he learn to design and arrange them himself, to calculate the warp and weft required to weave them, and to cut the cards or arrange the healds ? In a well managed factory, where everyone has his whole time occupied with his own duties, and where everything goes, as it were, by clock-work, no one has time to teach a learner these things. Even if there were the time, there might not be the desire to teach. The jealousy of overlookers is often so great, that instead of helping a person who comes to learn, they not unfrequently do much to hinder him. In proof of this may be cited a letter from a manufacturer in the south of Scotland, in which he speaks of the great difficulty of getting overlookers for carding machines. The jealousy of the overlookers is frequently so great that they prevent, if possible, anyone from learning the comparatively simple business of card-setting. The consequence is that the supply of overlookers is small, and their wages rise greatly, so that now it is difficult to obtain a good, or even an indifferent, overlooker.

Similar cases will occur to everyone who is acquainted with manufacturing. If there is such difficulty in getting good overlookers for card-setting, how much more difficulty will there be in getting good weaving overlookers? The result of the present system is, that very few succeed in mastering all the branches of their business. Those who succeed do so with infinite trouble, and after many mistakes; while the great majority only learn to work in one department, and are thus inefficient workmen all their lives. At a weaving school none of these difficulties are felt; for there are masters whose whole duty and interest it is to make their scholars as skilful as possible; and thus a regular supply of good overlookers is turned out. The benefit is thus shared by everyone. The overlookers receive higher wages, and the masters have their work better done. By the training which the masters themselves receive in these schools, they are able to look after their businesses more thoroughly, and to supervise work themselves, for which they would not otherwise be qualified.

There is another advantage which the school possesses over the mill. In a mill, as a rule, only one class of goods is made, and therefore a young man learning a business there, can only become acquainted with one branch of manufacturing. In a well-conducted school, he will become familiar with all classes of goods, and all materials. He

will know what style of article is required for each trade, and he will be able to introduce fresh styles and ideas into his own trade, when he goes into business for himself.

SUCCESS OF WEAVING SCHOOLS.

The fact that so many weaving schools exist in countries where the value of technical education is thoroughly understood, is in itself a sufficient proof of their utility. The Governments of the different countries would not continue to support and enlarge existing schools, and to found others, if their success had not been ascertained. Nor would the leading manufacturers subscribe largely, and help to manage some of the best schools in Germany and France, if they were not convinced that, from a business point of view, they answered their purpose. It is because they are regarded everywhere as profitable business investments that they are supported, and that the sons of manufacturers, and their workmen attend them. In the countries we have visited the whole educational system is so thoroughly organised by the State, and by municipal and other local authorities, that there is rarely any need, as in Great Britain, for private assistance. In almost every case it is considered that these authorities must undertake the work or it will be left undone. When, therefore, private citizens come forward in such a manner, and devote their

time and money to these weaving schools, it can only be on account of their great importance to the manufacturing interests of the country. By this we do not mean merely the interests of the millowners of the Continent, but also that of the whole manufacturing population, and especially that of the workmen who have been students in the schools. A weaving school differs from nearly all other schools in this, that it has no value apart from the influence it exercises on the manufactures of the country, by turning out manufacturers and workmen technically educated. The study of chemistry, geology, drawing, and other subjects, is interesting in itself, and gives pleasure to the student apart from any profit he may make by it. But no one would study weaving simply for pleasure, or would make the study anything but the means to an end. The existence of the continental weaving schools, therefore, and the number of their students, is ample proof that they are the best means for accomplishing the end for which they are established.

IMPROVEMENTS SUGGESTED FOR THE LEEDS SCHOOL.

We have not expected to find any one school of which we would wish to make the Leeds school a copy. Our object has rather been to notice the various points of superiority which any school might possess, and by uniting them in Leeds, to make

that school superior to any on the Continent. We believe that such an object is one which will meet with the approval of the Company of Clothworkers. The first requisite is to increase the size of the school. During the short time which the school has been open, it has been successful, and the number of students has increased. At present the number is too great for the size of the rooms, and there are not enough looms to do justice to all the students. It is not necessary to have seventy looms, as they have at Reutlingen ; for the system of teaching followed in Leeds, of only weaving small patterns, renders such a number unnecessary. It is desirable, however, that many more sample looms of various sizes and constructions should be added. A number of larger looms are also needed, in which different classes of goods of larger pattern can be woven ; and at least one loom of each of the principal constructions should be obtained. A ribbon loom would be especially useful, as it differs in some respects from all others. Such an increase in the number of looms as is needed to put the Leeds school on a proper footing, would, of course, involve an increase in the number of rooms. The rooms for theoretical work should be distinct from those in which the practical weaving is carried on, and should be so fitted up that each student can have a separate place—either a desk or cupboard—for his own work. There should also be a room in which samples of material and collections of

patterns may be kept, and in which such books on the subject of weaving and designing as can be obtained, may be formed into a small reference library. We do not recommend the use of power-looms. The expense of obtaining and working them is great, involving, as it does, an engine. For real education in the theory of weaving, hand-looms are decidedly superior; and the money which the power-looms and engine would cost can be much better employed in obtaining a greater variety of hand-looms, and all kinds of materials. Such an increase in the school would necessitate an increase in the teaching staff.

A collection of models of machinery used in the textile industries would also be very useful to the students both of weaving and mechanics. It might be difficult to obtain a collection equal to that in the Gewerbe Akademie of Berlin, or in the Conservatoire of Paris; but with the help of the Patent Office a good museum could be formed. If it be true that the Government has sent models of English machinery to the Polytechnic of Aix-la-Chapelle, no doubt they would be willing to do the same for Leeds. Instead of forming a large patent museum in London, as is proposed, it would be more useful to distribute the models throughout the country, sending those to Leeds which are connected with the manufacture of wool.

One of the most important points is to obtain a good collection of patterns of all materials, dating

as far back as possible. These could no doubt be obtained from merchants who had no further use for their old pattern books, and who would be glad to give them to the College of Science. A fresh supply of patterns should be obtained each year, to let the students see what patterns are being made. Periodicals on weaving should be taken in for their benefit; such, for example, as *The Textile Manufacturer* and *The English Mechanic*. The English translation of *Les Tissus* should also be obtained, and also *L'Ornement des Tissus*, a work of great use for designing. Other books of reference in connection with the subject should also be purchased as they are published.

DRAWING USEFUL.

It is very desirable that all the students should be able to draw, as otherwise their designs can never be what one would like to see them. Above all things it is necessary that their artistic taste should be cultivated. The stress which foreign schools of every description lay upon drawing shows how important it is considered for persons in every branch of life, and to none more so than to those engaged in designing patterns for the loom. Schools of art have done much for English education in this respect, but the want of taste in so many kinds of English manufactured goods shows how much needs still to be done. A

knowledge of dyeing, and of chemistry as applied to manufacturing, would also be very useful to the students; and it would not be difficult to organise a class, at any rate, for the last-mentioned subject. If dyeing were taught, separate rooms would have to be fitted up for the purpose, with the necessary appliances. Whether this would be practicable, it is not for us to say; but were such a class in operation, it would be an advantage to the students of weaving. If arrangements could be made by which they would be allowed to visit the manufacturing establishments of the town and neighbourhood, it would also be for their advantage. They could see the various processes being carried out in a more practical and complete way than is possible in a weaving school, and would get a better knowledge of machinery. There is, of course, some inconvenience to the manufacturers in such an arrangement, but they would be compensated for it in the end by a more efficiently trained staff of overlookers and managers being turned out from the school.

DIPLOMAS SHOULD BE GRANTED.

It would no doubt add greatly to the efficiency and popularity of the College of Science if some system of prizes for original work, and diplomas and scholarships, were adopted. All experience shows that it is useless, in the great

majority of cases, to expect persons to study merely for the sake of intellectual improvement. They cannot make their studies an end in themselves; they must be looked upon as the means to an end. The example of our Universities proves this. There, if anywhere, one would expect to find learning pursued for its own sake. But the phenomenon is as rare there as anywhere else. A large number of students go to the Universities merely to qualify themselves for some profession. Of the remainder, most study to obtain those honours in the form of fellowships, scholarships, or degrees, which the University alone can give. It is not necessary that there should be a pecuniary reward given for their study, though most students can bear witness that such rewards prove an effective stimulus. The honour of a scholarship, or a degree, is the chief thing coveted; for everyone wishes to have the praise of his fellow men, and is proud of having something to show for the work he has done. This feeling operates just as much in those who attend the College of Science as in those who are students at the Universities. Indeed it has additional strength in the case of the former. The majority of the students at the weaving school will probably become overlookers and managers of mills. They very reasonably expect that they will thus be rewarded for the time and labour they have given to their studies, or, failing these appointments, by becoming more efficient

workmen and receiving higher wages. But they must have something to show as a proof that their time in the school has not been wasted. A person may attend the school and yet not profit much by it. But he must not be allowed to claim that he has received as good an education as the industrious student. A diploma should therefore be conferred upon those who pass their examinations with the greatest credit, by which they should be entitled to some such designation as "Master Weaver." For those who pass with less distinction, second class diplomas, or certificates, could be awarded. It is not desirable that there should be many grades of these diplomas; for the public cannot be expected to remember the different qualifications necessary for each grade. Probably two are quite sufficient. They should not be easily obtainable, and the highest, at any rate, should require the study of those subjects which are included in the programme at Verviers. To the few who show remarkable ability, there should be given travelling scholarships, to enable the holder to visit other countries, or to study special subjects at the higher scientific colleges, or the Universities. Such scholarships might be confined to working men, but the diplomas should be given to all who can obtain them. For the other departments of the College, other diplomas should also be given.

The advantages which these diplomas and the

technical education given on the Continent confer on both workmen and masters cannot be better shown than by quoting from a speech of M. Havrez to the students of the Verviers Professional School. "The advantages," said he, "which the overlookers and workmen can obtain from these diplomas are so evident that I need scarcely dwell on the point. You know that when the dull season for industry comes, it is the worst workmen, that is to say, the most ignorant, who are first discharged. Besides, the instruction which you must receive to enable you to obtain the diplomas, will increase your wages, because your labour will bring more than that of the ignorant workmen ; and finally because in case of stopping the machinery or giving up business, you will be dismissed last of all, and in all cases for the shortest time possible ; for your employers will be afraid of finding you engaged elsewhere, when the time comes when they wish you to return. Far from fearing the introduction of new machinery, you should wish for it ; knowing that, in order to manage it, there will be needed labour more intelligent, more useful, and more rare.

"Moreover, are the diplomas not a guarantee for the manufacturers of your courageous perseverance and of your knowledge ? Some years ago," he went on to say, quoting from the speech of M. Le Hardy de Beaulieu, delivered on a different occasion, "there was founded in Lille a course of instruction for firemen or stokers. The young

workmen received all the knowledge of heating boilers well, and for keeping them in good condition and safety. Those engaged in the working of mines soon perceived that the workmen who came from this school heated the boilers better and with less coal than did other workmen ; and that they escaped many accidents and repairs, and stoppage of machinery. These firemen were therefore much sought after ; and everywhere they were, very properly, able to demand higher wages, because their work was of more value to their employers. Already in Charleroi," continued M. Havrez, "the situations of foremen in collieries, furnaces, and mechanics' shops are only given to those overlookers who have obtained a diploma of Professional School of Charleroi. This appreciation of the utility of industrial science makes us foresee, that a time will come in Verviers when the situations of overlookers and directors will only be reserved for the holders of the diplomas of the Professional School."

To complete the system of rewards which the College of Science should have at its disposal, prizes should be offered on the same principle as those given by the Industrial Society of Rouen. The students can hardly be expected to do much literary work, or to make discoveries or inventions to qualify them for receiving diplomas ; but, as all such work should be encouraged, these prizes might be offered as extra inducements to study special

subjects. There appears to be no restriction as to who may compete at Rouen, and perhaps it would be proper, at first, to have no restrictions here. In course of time, however, the competition might be limited to former and present students at the college, and thus another advantage would be gained by those who attend its classes.

NECESSITY FOR SCHOLARSHIPS.

There are, no doubt, many young men who would gladly profit by the instruction given in the different classes of the College of Science, if they had the means of attending it. Being obliged to work for their living, they not only cannot obtain money to pay the class fees, but they could ill afford the money which would be necessary to keep them during their course of study. A double system of scholarships is needed, by which part of the money should go to pay their fees, and the remainder should be devoted to their maintenance. In every province of Prussia there are eight free scholarships to the Gewerbe Akademie of Berlin, which are competed for in the various real and gewerbe schulen in the country. Though the students pay nothing, the Akademie receives 2*l.* 14*s.* a month from the State for each free scholar. In England, the only corresponding scholarships are those given by the Science and Art Department to South Kensington, by which any young artizan

who passes a certain examination receives free education in one or more subjects in London, and is granted 1*l.* a week for his expenses. This system should, if possible, be made applicable to the College of Science. Instead of giving each student 1*l.* a week for his expenses, which is more than would be necessary in Leeds, he might only receive a portion of that sum, and the remainder could be paid to the college for his fees. The school at South Kensington, being supported by Government, can, of course, take in free students; but such a plan would be impossible in a college supported by voluntary effort. The one thing, however, which must be kept in mind in arranging any system of scholarships, is that part of the money must go to support the student, as compensation for the loss he sustains in not being able to work at some trade while pursuing his studies.

If any such scheme as we have suggested were carried out, the first question would be, where are the young men to get sufficient education to enable them to compete for these scholarships? The fees of the college might be so much lowered as to be within the reach of all, or they might be abolished altogether, and yet only a few working men would be found who were able to take advantage of it. This does not apply merely to those who have arrived at manhood; the difficulty is as great for those who are still in their teens. One would naturally look to those who attend the evening classes of

mechanics' institutes as being most likely to compete for any scholarships that the college could offer. But the complaint of all those who manage and promote the work of mechanics' institutes is, that the young men cannot learn even elementary science, because they are deficient in the rudiments of education. For example, many of those who come anxious to learn mathematics, cannot do so, because they are comparatively ignorant of arithmetic. Again, those who wish to profit by lectures, and to take notes, are prevented from doing so because they are not sufficiently able to write ; while with others, the text-books that are placed in their hands are of little use, because the students are unable to read them with advantage. So long as this is the case, any attempt to provide even elementary scientific education for the mass of the people can only be partially successful. Those who know what the system of education in Germany and Switzerland is, can realise the backward state of this country, and the almost total want of organisation which exists here. In England, it may be said that the mass of the people have no means of giving their children any but the most elementary education, such as is obtained at the public elementary schools ; and this education stops at the age of thirteen or fourteen. A few children may be sent to night schools where there are any, but the majority are left to keep up their learning, or forget it, just as they like. The schools

for the middle classes are expensive, and often far from satisfactory. They are comparatively small, and in consequence good masters cannot be obtained. It is no exaggeration to say that many of those who leave an ordinary middle-class school have not sufficient education to enable them to enter the College of Science.

GERMAN SYSTEM OF EDUCATION.

In Germany and Switzerland a very different system prevails, which results in giving such a training as allows young men all over the country to attend in great numbers those polytechnic and other scientific and industrial schools which are the pride of almost every large town. In North Germany, for instance, the plan of education is as follows: From six to fourteen years of age attendance at school is compulsory. At six years old the children go to the primary school, and in all cases stay there till they are ten. As a general rule the children of the working classes remain at the primary school till they are fourteen, and during the last two years of their attendance they may work half-time in a mill. In the primary school, however, much more is taught than in our elementary schools, and our sixth standard is not as high as their highest standard. Those children who, at ten years of age, can pass a certain examination may leave the primary school, and go either to the

"Gymnasium" or classical school, or to the "Real" or practical school. Many of the working people, and all the middle classes, take advantage of these higher schools; and thus at ten years of age their children begin to get a secondary education. Those children who are intended for professions, or whose parents prefer classical teaching, go to the Gymnasium, where they may stay, if they wish, till they are eighteen, when they can go either to the teachers' seminary or to the university. Those who are intended for business go to the "real schule," where they may also stay till they are eighteen; or they may leave it and go to the gewerbe or trade school, where the education is more technical. At eighteen those who wish go to the polytechnic school, where, as in the university, the course lasts for three or four years. For girls there are secondary schools, corresponding in efficiency either to the gymnasium or "real schule." Thus the steps from each school to the one above it are gradual, and the whole system hangs together. The fees, too, are so low, that the whole course is within the reach of the mass of the people, and is taken advantage of by them. There are also many schools for teaching one special trade, such as weaving, mining, farming, sewing, etc., and also singing, which are considered of great use to the various industries of the country.

SWISS SYSTEM.

In Switzerland the system is slightly different, and if possible more complete. Take, for example, the school system of the little town of Winterthur, in the Canton of Zurich. All the education given there is free, and is compulsory till the scholars are fifteen years old. When they are six they go to the elementary or primary school, where boys and girls are taught together in the same classes. They remain there till the end of their ninth year, when they are separated, the boys going to the boys' "real" school, and the girls to the girls' "real" school. In the "real," as well as in the elementary school, no class consists of more than about sixty scholars, and each class has a room to itself. At the end of their twelfth year the girls are advanced to the secondary school, where they stay till they are fifteen. If they wish to continue their education, they go to the higher girls' school, where they may stay till they are eighteen, after which both the polytechnic and the University of Zurich are open to them equally with men. When the boys have completed their twelfth year, they decide whether they will follow the classical or practical system. If the former, they go to the gymnasium, where they may stay till they are eighteen or nineteen; and then go to the university. If they choose the practical side, they go to the secondary school till

they are fifteen. At fifteen, if they wish to continue their education, they either go to the industrial school till they are eighteen, and thence to the polytechnic at Zurich; or they go to the Technicum of Winterthur, which is a lower form of polytechnic, and fits the students specially for the trades of the town. With such a system it is not surprising that the polytechnic and University of Zurich each have about seven hundred students; and that even those who do not carry their education thus far, begin life with an education superior to that which nine-tenths of young men in England have the means of obtaining.

GOVERNMENT SUPPORT OF SECONDARY EDUCATION.

The explanation of this success is to be found in the fact that all education is controlled and supported by the local authorities and by Government. The municipality or other local authority builds and supports the elementary and secondary schools. The Government supports the universities and polytechnics, and contributes to the gymnasia. In consequence of these public grants, education is given to the students at less than cost price, and in many cases is free. This is not merely the case in Germany and Switzerland, but also in Austria, Belgium, and France. The technical schools are usually supported by the town and Government

jointly. If the English system of education is ever to compete with that on the Continent, the question of giving aid to secondary and technical schools from the Imperial taxes and the local rates must be faced. The general idea here is that the duty of the State with regard to education ceases when the child possesses the keys to higher knowledge; and that an elementary education is all the State should offer. This theory, however, is not consistently carried out. It is violated to some extent by the grants given by the Education Department for special subjects, and also for singing, which can hardly be called a necessary branch of education, though very desirable. It is also violated by the grants given by the Science and Art Department for drawing in all its branches, and science, when taught to artizans. The provisions in the Elementary Education Act which allow school boards to open secondary schools is also a violation of the principle. These violations, however, are so generally approved of, that the principle is rapidly becoming more honoured in the breach than in the observance. When this is the case, why should not an effort be made to establish the opposite principle, namely, that it is the duty of the State to provide a complete system of education. In Scotland, the burgh schools in the chief burghs, which correspond to the English grammar schools, were put under the school boards by the Education Act of 1872. As a foundation for such a system in

England, the grammar schools might have been also put under the school boards, who are the natural authorities to manage all educational endowments. Where such schools did not exist, or were insufficient, the board should be allowed to build others, both for boys and girls. The fees in these schools should be low enough to let the higher education be within the reach of all ; and, as has often been suggested, scholarships should be given to the cleverest boys and girls in the elementary schools to enable and encourage them to continue their education, even up to the University or College of Science. Although such higher schools would be mainly for the poorer inhabitants of towns, it would be unreasonable to object to the children of richer parents attending them, because the chief burden of the rates falls on the rich. If the teaching in these schools was so good that the children of the middle classes came to them instead of going to private schools, as at present, so much the better for the children. It might be a hardship to some masters of private schools, but as education is meant to benefit the children and not the teachers, that need hardly be considered ; especially as such masters would in most cases be successful competitors for positions in these secondary schools. It would be necessary to make these secondary schools like the German "real" school rather than like the gymnasium. The wants of the working and lower middle classes lie in the direction of the former rather than of the latter. At present, in the

grammar schools which have both classical and commercial sides, the commercial side is pretty sure to suffer. The masters have a tendency to favour the classical school, because it leads to the University, and savours more of the great English public schools. If justice is to be done to the commercial school, it must be in a separate building, as it is in Germany, and be kept quite separate from its overpowering classical neighbour. Each town will soon find out how many of these secondary schools it needs, and the educational institutions of the country will be put on a more satisfactory foundation.

The school boards might also be empowered to build industrial technical schools for both boys and girls. In doing this no better model could be found than the Municipal Professional School of Reims. It has been built by the town for the technical education of the sons of the working men. Boys go to it immediately after leaving the elementary school, and stay there three years. During their course they are taught the various branches of a higher education, including English and German, and they are also prepared for their work as weavers, mechanics, clerks, etc. For all this the fee is 4*l.* a year, and the town pays the fees of those who are unable to pay for themselves. Admission to such a school should be dependent on passing an examination, and would be looked upon as one of the greatest prizes to be gained in the lower school.

GOVERNMENT GRANTS FOR THE COLLEGE OF
SCIENCE.

With regard to the means of supporting and extending such institutions as the Yorkshire College of Science, it would scarcely be fair to charge any portion of it on the local rates; except to this extent, that all the school boards of the riding or county might be allowed to establish scholarships at the college, to be competed for by the young men and women of their districts. The support of the College of Science falls most properly on the Government, in the same way as does that of the polytechnics of the Continent. Everyone on the Continent to whom we spoke of our college, as being founded and supported by voluntary subscriptions, was astonished that such a thing was possible. The continental idea is to let the Government or the local authorities do everything, and the private person nothing at all. Such an idea is, no doubt, as far wrong as the opposite idea, that the Government should do nothing for higher education. The plan which has been followed more than once, notably in the case of the new Glasgow University buildings, seems a good one, namely, that the Government shall give a sum equal to that raised by local subscriptions. A guarantee is thus given that a district really wishes to have a certain college or other building, and has made an effort to

obtain it. It would also be reasonable to expect that the Government should give an annual grant towards the expenses of our College of Science, in the same way as it gives grants to the Scotch Universities. Unfortunately, Parliament watches the increase of the education estimates with greater jealousy than those for the army and navy; and seems unwilling to grant any increase which is to be devoted to the educational welfare of the people, by means of secondary schools. We believe, however, that a feeling is growing in the country in favour of grants to scientific and technical schools, and that ere long the claims of the Yorkshire College of Science will be recognised. It will then be able to complete that extension which it is understood to be the intention of the Worshipful Company of Clothworkers so generously to commence, and will become an institution of which not only the West Riding, but all Yorkshire, may be proud.

INDUSTRIAL SCHOOLS FOR GIRLS AND YOUNG WOMEN.

Although the subject of industrial and commercial schools for girls does not come directly within the range of this Report, yet, knowing the interest which your Worshipful Company takes in the education of girls, and the help which you give for that object, we wish to call your attention to a system of instruction on the Continent which supplies for girls the same want which the technical schools supply for boys. Within the last few years, in many of the chief towns of Germany and in Brussels, schools have been opened with the object of giving to girls a commercial and industrial education, which will enable them to occupy situations in offices and counting-houses, as well as qualifying them to be designers in porcelain and textile manufactories. The usual branches of dressmaking and fancy work are also taught in these schools, which have, in most cases, been founded and are managed by associations of ladies. They are supported by the subscriptions of friends, and the fees of the students; though in one or two instances they receive aid from the town. Those which we visited were in Brussels, Berlin, Prague, Vienna, Munich, and Reutlingen. There are, however, others in the chief towns of Germany.

"PROFESSIONAL SCHOOL" AT BRUSSELS.

The Professional School for girls in Brussels, in the Rue des Marais, was founded in 1865, to improve the condition of girls. As the Report truly says: "The creation of the school has satisfied a legitimate want of the working class; it has come to fill an important vacancy. Those women who seek the means of existence by work often find themselves under the most difficult conditions. Subject to a long apprenticeship; having generally, as directors of the first steps of their professional career, employers of small intelligence who are interested in keeping their workwomen in an inferior and dependent position, these women in most cases only obtain a salary quite insufficient to repay them for their hard work. It is to ameliorate their condition, to combat their ignorance and their destitution, the sources of all their misery and their degradation—in short, to offer them better chances in life, that the Professional School for girls has been founded. Its object is not merely to furnish a professional education—to familiarise the girls with the practice of the profession or trade they wish to follow. It aims also at preserving and developing the benefits of the instruction received at the primary school." The idea of founding the school originated with a few persons who appealed to the public for help. In a short time

the number of subscribers reached one hundred and thirty-four, the majority of whom promised subscriptions of at least thirty-six francs a year, that sum being at first fixed as the school fee. The municipal council promised an annual subscription of 3600 francs, obtaining thereby the right to send one hundred girls to the school as free scholars. With this income the school was opened, and sixty girls were enrolled. Up till 1868 the school remained a private one, but in that year the municipal authorities declared themselves willing to adopt it as one of the public schools of the town. At their suggestion the Government agreed to subsidise it, by which means it has reached its present position. It is still aided by subscriptions, and the subscribers, who number three hundred, elect from among themselves a committee to manage it. The instruction is in two courses, general and special. The former includes French, Flemish, arithmetic, history, elements of natural history, natural philosophy, and chemistry, as applicable to the wants of life; questions on education, hygiene, and domestic economy; writing and ornamental designing, singing and gymnastics. The special course includes commercial knowledge, such as book-keeping, commercial arithmetic, commercial law, and English or German; industrial designing, chiefly such as is applicable to millinery and dressmaking, and the manufacture of porcelain; painting on porcelain, dressmaking, cutting out, and the getting up of

linen ; the manufacture of artificial flowers ; painting on fans and various stuffs. So popular has the school become that the number now in attendance considerably exceeds three hundred. In 1874 there were two hundred and eighty girls, of whom one hundred and thirty-three paid the fees, eighty-seven were admitted free by the chief subscribers, and sixty were sent free by the town. Several of the neighbouring communes have founded scholarships to the school. As a proof of the quality of the work done in the school, they have received medals for things exhibited in various exhibitions, and a diploma of excellence was awarded to them at the London International Exhibition of 1871. Their report further mentions that some of the most elegant dresses for the court balls have been made in the school. We saw a number of the girls at work, designing and doing embroidery, making flowers, and painting ; the work appeared to be tastefully designed and exceedingly well done. At the end of the course those girls who pass an examination obtain certificates of proficiency. The method of examination in dressmaking, for instance, is this : A certain amount of material is given to a girl, which she has to make into a dress and fit on to a lay figure. In judging her work, the taste displayed and the exactness of the fit, etc., are taken into account. As might be expected, the girls and young women who leave the school easily obtain lucrative employment, in whatever

business they have been trained to follow, and enter life with a thorough knowledge of their work, which will enable them to push their way in the world. To show the increasing prosperity of the school, we may mention that their receipts have increased from 11,200 francs in 1865 to 59,000 francs in 1872, while their expenses have increased from 10,800 francs to 37,000 francs during the same years.

GERMAN SCHOOLS : BERLIN.

The schools in Germany have been founded in much the same way, and their success has been equally great. With the exception of that in Munich, which was founded in 1873 by the municipality, and under the presidency of the Burgo-master, Dr. Widinmayer, has prospered greatly, all the German schools have been founded by associations of the leading ladies in the various towns, and are managed by them generally without any assistance from men. In this they differ from the Brussels school, which appears to have been the work of gentlemen. The association in Berlin, or, as it is called, the "Lette-Verein," has its school at No. 90, Königgratzerstrasse, and is a union of various committees, under the patronage of the Princess Imperial of Germany. The school is in three divisions, commercial, industrial, and drawing. The list of subjects is much the same as in Brussels, the commercial department being rather

more complete. Telegraphy is also taught, and many young woman are employed in telegraph offices who have been taught there. There are over two hundred students altogether, who pay fees varying from 4s. to 15s. a month. In the same building is the "Viktoria-Stift," or Victoria Charity, connected with which is a boarding house where pupils at the school, and other young women, can lodge at a low rate. Another department is the Victoria Bazaar, to which any lady in the town can send her fancy work, to be sold for her own benefit. This is largely used by the ladies of Berlin. The conditions on which work is received at the Bazaar are, that the workmanship must be good, and that the article has not been washed, and yet is quite clean. Another department of the Association's work is to find employment for women in such situations as governesses, nurses, ladies' assistants, clerks, salewomen, cutters-out for tailors and linen warehouses, copyists, etc. ; and large numbers have been helped in this way. There is also the Charlotten Stiftung, or charity for helping the needy daughters of noble and military families. Besides these there is a school for compositors, which is joined to a company under the title of the Berlin Printing Company, 47, Ritterstrasse, started by several gentlemen on purpose to help the school. Each of these departments of the Lette-Verein is managed by a separate committee, on only two of which are there any gentlemen.

Attached to the school of the Association is a cooking school, which is largely attended by girls of the middle and upper classes. The food cooked is sold in a restaurant for ladies only, for which the pupils do all the cooking. The cooking school pays its own expenses. The loss on the other schools, etc., is made up by yearly subscriptions, which range from a few shillings to two or three pounds. They also receive numerous donations. Among these are 150*l.* from the Princess Imperial of Germany, and 15*l.* and 20*l.* from the Emperor and Empress.

LADIES' ASSOCIATION IN VIENNA.

The Ladies' Industrial Association (*Frauen Erwerb Verein*) of Vienna, 4, *Rahlgasse*, is one of the best of these institutions. It was founded about five years ago by *Frau von Neuvall*, and is now managed by a committee of ladies, with a few gentlemen as an extraordinary council. It is divided into eleven schools ; namely, for commerce, French, English, stenography, drawing, higher working school, sewing, cutting out, point lace work, telegraphy, and general improvement. The fees range from about 4*l.* 10*s.* to 1*l.* a year, and the school is well attended. The committee finds situations for girls who desire them, when they leave the school. There are two ways in which work is found for the girls in the school. They may bring their own work and do it there, or ladies

send work to be done. In the former case the girls can get work from shops or from their friends, and so earn money. In the latter case the ladies who send work pay for it being done, and the girls thus receive payment for their services. Many ladies get their dresses made at the schools, and thus a system of what may be called co-operative dressmaking is established, by which both the employers and the employed benefit. Subscriptions are needed here also to meet the loss on the school, but these are easily obtained.

SCHOOLS IN OTHER TOWNS.

The Frauen Erwerb Verein of Prague has two schools; the chief one in Herrngasse, No. 6, and a branch at 14, Rosengasse. In the latter place machine knitting, and cutting out, and sewing, are taught. In the former there are the commercial schools, dressmaking school, and schools for telegraphy, and educating teachers for the kindergarten system. Altogether, there are more than two hundred scholars. The schools receive grants from the State, the province of Bohemia, and the town of Prague. They also receive a handsome sum yearly from a performance at the theatre, which is given for their benefit. The management of this school is confined to ladies.

Although the Munich Frauen Arbeits Schule has been open only since 1873, it has about two hun-

dred scholars, who learn hand-sewing, knitting, machine-sewing, dressmaking, fancy work, drawing, arithmetic, book-keeping, etc. The fee is three florins a month, but those who are unable to pay are admitted free. The fact that they have sixty sewing machines will give some idea of the amount of work done. In connection with this school is a seminary for teachers of work, where a general education is given, as well as practical instruction in sewing, etc. A higher girls' school is also in the same building, 17, Ober Anger, which is attended by two hundred girls, many of whom are free scholars.

The only other of these girls' schools which we visited was that in Reutlingen. It is in the same building as the weaving school; but is soon to be removed to more convenient quarters erected for it. Five years ago the school was opened by a lady with only six girls. Now there are more than two hundred, and it is assisted by the town and the State. It has five divisions: plain sewing, such as shirts, collars, etc.; making of dresses and clothes; machine sewing; embroidery; and fancy woollen goods. All learn drawing. The girls either work for themselves or for the school, in which case they are paid for what they do. The directors can always sell the articles made, and often receive orders from shops for goods beforehand. The school is bound to make as much as it can in this way, and the deficit is supplied by the town and State.

In the Exhibition of German Manufactures, held

at Munich this year, a considerable quantity of work done in the different girls' schools was shown. That done in Munich was well able to hold its own against all others for taste, design, and good workmanship. The Frauen Arbeits School is not, however, the only school of the kind in Munich. Very beautiful work was exhibited from the Kunst Industrie Schule, No. 2, Frauen Platz, and from the girls' department of the Kunst Gewerbe Schule of Munich. These consisted of artificial flowers, paintings on silk from nature, paintings on wood ; designs for tiles, wall papers, cups, plates, fans, and house decorations ; also patterns for damask tablecloths and napkins drawn on point paper. These were marked "Executed for Brüne and Lippelt, manufacturers, Brün." It would appear from this that manufacturers in Austria employ girls in the schools of Munich to design patterns for their goods. The advantage which the girls must reap from such a system is incalculable ; for when they leave the school they no doubt continue in the employment of those firms for whom they have made patterns previously, and an honourable and lucrative trade is thus open to them. Excellent work was also exhibited from the girls' school at Reutlingen, and from similar schools at Calw, Stuttgart, and Biberach. We were told that there are schools of the same kind at Darmstadt, under the patronage of Princess Alice of Hesse Darmstadt, and also at Hamburg.

NEED FOR SUCH SCHOOLS IN ENGLAND.

It is greatly to be regretted that such schools do not exist in this country. They would supply a want which is greatly felt here, especially by that class of girls and women who look upon the position of a governess as their only means of earning a living. They have the ability and the taste to become designers, but they need the technical instruction, which at present it is almost impossible for them to obtain. They want also the recommendation of having studied at some such school, to induce manufacturers to employ them ; but if it were known that they had had such a training as the German girls receive, they could easily obtain remunerative employment, in many ways. The great increase in continental fancy work which has come to this country within the last few years is also to be partly attributed to these schools. The continental nations may perhaps have more natural taste than the English, as is asserted by many persons ; but without some training, both in designing and working, it would be impossible for them to produce the superior class of fancy work and embroidery, which annually comes to this country. It would be desirable, too, for girls to be taught the Kindergarten system of education. Now that school boards have to provide for a large number of children who are little more than infants, the Kindergarten system may be more generally carried

out. At present its development is checked by the scarcity of teachers; but if they were to be found, they would soon obtain employment in the honourable calling they had chosen. The employment of women as clerks is comparatively rare here except in the post-office service. This arises to a great extent from the fact that no young women are trained for the work. Unlike men, they do not go in when young, and work their way up. If they could be engaged ready trained, they would find a market for their services, and would soon be able to compete with men.

SCHOOLS FOR DRESSMAKING.

The schools for dressmaking and sewing, perhaps, offer the widest field to those who may open them. If the ladies in each of our large towns were to organise a school for sewing and dressmaking, for which they should have one or more competent mistresses, there would be no lack of pupils, who would pay a small fee. Those who wished to bring their own work could be allowed to do so; but the aim of the committee should be to get work from the ladies of the town. They could send dresses and other articles to be made, as is done in Vienna; and as the committee would not need to make a profit, the work would be much more cheaply done than by any professional dressmaker, the girls receiving at the same time proper

payment. A class of trained dressmakers would gradually be formed, who could obtain lucrative employment as forewomen in large establishments. If diplomas, or certificates, were given similar to those in Brussels, a certain dignity would accrue to the holders, and women of more education and better social position would qualify themselves for the position, and would rise from being forewomen to be mistresses of their own businesses, or teachers in other schools. A large number of sewing mistresses will be needed for the elementary schools, now being built by school boards; and for these responsible positions it is of the highest importance that women of education should be obtained. The great aim in the question of opening new pursuits to woman should be not merely to enlarge the number, but especially to add dignity to the calling. Nothing lowers the standard of any employment, either as regards the estimation in which the public hold it, or the payment which those employed receive, so much as flooding the market with unskilled labour. This is what is being done with most of the occupations that are now open to women. The result naturally is that the labour produces very little remuneration, and the women starve upon their small earnings. What is needed is to elevate their trades, by giving a technical education to those employed in them, so that, on account of their greater skill, they may be entitled to receive a higher salary. Those who do some-

thing in this direction will have the reward of seeing their work better done, and will have earned the gratitude of thousands of women, for whom their far-sighted benevolence, and sense of justice, have opened up careers of useful and profitable employment.

We have the honour to be, Gentlemen,

Your obedient servants,

WALTER S. B. McLAREN.

JOHN BEAUMONT.

APPENDIX I.

LIST OF POLYTECHNIC AND OTHER SCHOOLS IN WHICH WEAVING IS TAUGHT.

Aix-la-Chapelle Polytechnic.
Berlin Gewerbe Akademie.
Prague German Polytechnic.
Prague Bohemian Polytechnic.
Vienna Polytechnic.
Stuttgart Polytechnic.
Paris Conservatoire des Arts et Metiers.

Lille Industrial Institute.
Ghent Industrial School.
Verviers Professional School.
Mülheim Weaving School.
Crefeld Weaving School.
Elberfeld Private School.
Barmen Art and Trade Association.
Einbeck Weaving School.
Chemnitz Weaving School.
Meerane Weaving School.
Gross-Schönau Weaving School.
Vienna Weaving School.
Passau Weaving School.
Heidenheim Weaving School.
Reutlingen Weaving School.
Mulhouse Weaving School.
Reims Municipal Professional School.
Reims Industrial Society.

Elbeuf Industrial Society.
Elbeuf Private School (M. Bertin).
Elbeuf Private School (M. Sorret).
Rouen Industrial and Commercial School.
Rouen Industrial Society.
Amiens Industrial Society.

The following schools we did not visit :

Weimar, Laichingen in Wurtemberg, and Hof near Münchberg, in Bavaria.

Weaving schools will soon be opened at the Polytechnic of Munich and at Zurich.

APPENDIX II.

INDUSTRIAL, AGRICULTURAL, AND COMMERCIAL INSTITUTE OF THE NORTH OF FRANCE, LILLE.

SUMMARY OF PLAN OF STUDIES.

INDUSTRIAL SCHOOL.

DIVISION OF TECHNOLOGY.

Three Sections.

- I. Mechanical Arts. II. Spinning and Weaving.
III. Chemical Industries.

First Year.

Course common to the Three Sections.

Elementary mathematics ; descriptive geometry ; measurement of plans, and surveying ; elementary mechanics ; general physics ; general chemistry ; zoology and botany ; geology ; accountantship ; general principles of law ; and English or German.

Course common to Sections I. and III.

Industrial chemistry.

Special course for Section II.

Spinning and weaving ; introduction and first notions on textile materials, and the different operations in spinning and weaving.

Second Year.

Course common to the Three Sections.

Steam engines ; industrial physics ; industrial constructions ; industrial and commercial geography ; industrial hygiene ; political economy ; commercial law ; industrial

legislation (laws and regulations respecting steam apparatus, unhealthy establishments, the employment of children, etc.) ; and English or German.

Course common to Sections I. and II.

Applied chemistry ; construction of machines.

Course common to Sections I. and III.

Metallurgy ; sugar refining ; and distilling.

Course common to Sections II. and III.

Bleaching, dyeing, and finishing.

Special course for Section I.

Spinning and weaving (construction of machines) ; agricultural machines ; working of mines ; railways.

Special course for Section II.

Textile materials studied from the agricultural and commercial point of view. Spinning linen, hemp, jute, cotton, wool, silk, etc. Weaving plain and figured goods, etc.

Special course for Section III.

Analytical chemistry ; industrial mineral chemistry ; industrial organic chemistry ; mineralogy ; and geology.

DIVISION OF CIVIL ENGINEERING.

This division is a three years' course. It is divided into four sections, viz. constructions, working of mines, chemical industries, and spinning and weaving. The programme of the course is very similar to that of the division of technology, but is somewhat fuller. There are also in both divisions practical exercises. These are : Drawing, six hours a week ; the exercises in drawing are, like all the practical exercises, applied to the different specialities ; thus, the students of weaving are particularly practised in ornamental design. Practice in the workshop and chemical laboratories, two and a half hours daily. Excursions : During the summer, one

afternoon a week is devoted to visits to factories, workshops, etc. The students have to present at the end of each excursion a notice of the establishments visited, with sketches made in the place. Examinations are held at stated intervals.

AGRICULTURAL SCHOOL.

First Year.

Elementary and applied mathematics ; elementary mechanics ; general physics ; general and agricultural chemistry ; zoology and botany ; agriculture ; accountantship ; general principles of law ; English or German.

Second Year.

Steam engines ; industrial and rural constructions (study of materials, execution of works in masonry and in wood or iron, types of industrial and rural buildings, construction of roads) ; analytic chemistry ; industrial and organic chemistry ; sugar refining and distilling ; mineralogy ; geology ; special agriculture ; hydraulics as applied to agriculture ; agricultural machines ; veterinary art ; textile materials ; agricultural geography ; industrial and commercial geography ; hygiene ; political economy ; commercial and agricultural law ; industrial legislation ; English or German.

Practical Exercises.

Drawing ; practice in the workshop (joinering, etc.) ; chemistry (analysis of materials relating to agriculture, processes for discovering adulteration in manures, etc.) ; excursions (made under the guidance of a special professor, to allow the students to follow the work which is

being carried on during the different seasons on the principal farms near Lille); practice in cultivation (a special field near Lille is used for different experiments in cultivation, and specially for comparison of the results obtained by the aid of different manures). Examinations are held at stated intervals.

COMMERCIAL SCHOOL.

First Year.

Elementary mathematics, physics, chemistry, and natural history; accountantship; merchandise (study of materials and manufactured products); industrial and commercial geography; law; English and German (both obligatory); Italian or Spanish (optional).

Second Year.

Commercial arithmetic and accountantship; political economy; commercial law; merchandise; commercial geography; history of commerce; fiscal and custom-house legislation; hygiene; English and German; Italian or Spanish.

Practical Exercises.

Caligraphy; commercial office (book-keeping, preparation of all documents used in business, and complete series of supposed commercial operations); drawing and sketching; practical study of the processes of rapidly testing goods, such as are used in commerce for finding the degree of purity in those articles most exposed to adulteration; excursions (visits to commercial establishments, etc.). Examinations held at stated periods.

APPENDIX III.

PROSPECTUSES OF THE WEAVING SCHOOLS OF MÜLHEIM, VIENNA, CRE- FELD, CHEMNITZ, AND MULHOUSE.

PROSPECTUS OF THE WEAVING SCHOOL AT MÜLHEIM AM RHEIN (RHENISH PRUSSIA).

Under State auspices, this establishment has existed for a number of years, with very satisfactory results. Under the care of the undersigned trustees it is conducted by tried teachers, and devotes itself to the task of educating overseers and manufacturers in all branches of weaving, and to furnish young men who wish to become buyers or sellers of manufactured goods with an exact knowledge of manufacturing, and thereby with a correct judgment of goods.

Completely to fulfil this aim, the instruction extends from the weaving of different sorts of simple and mixed stuffs (such as linen, cotton, wool, silk, etc.) to the drawing out of weaving plans for fancy stuffs, and to the independent composition of patterns. After the arrangement and composition of these have been learned in the under-mentioned order, the scholar will receive advice on the following points, very important in the practical exercise of his trade :

1st. Upon the arrangement and colouring of the

different classes of raw materials and the dressing of the goods manufactured from them. The establishment possesses a laboratory and a dye-house, in which, under the direction of a chemist and a dyer, instruction is given in the theoretical relations of the combined dyes, and also in the preparation and practical application of them.

2nd. Upon calculations for patterns, by which the scholar is enabled to fix the arrangement of materials for the article to be manufactured, and to manage it in the most profitable way.

Note.—The institution has made it a primary principle to make practical men and not theorists. Its aim is therefore not directed towards burdening the scholar with unpractical learning (which too often means only loss of time, and leaves him farther from his proposed object), but rather to lay before him, in a simple, practical manner, that which will enable him to thoroughly understand whatever is of importance, in the special line that he proposes to follow, and will enable him to attain his object, in the shortest possible time, compatible with thorough knowledge.

Should the scholar wish to turn his attention specially to any one branch of weaving or dyeing, the teaching of the school is arranged so as to enable him to do this, without altering its usual course.

The course of instruction consists of the following four divisions :

First Division.

INTRODUCTION.—General instructions in the preparation of the raw material for weaving ; of the warp and weft ; of the implements necessary in weaving ; of the loom and its management previous to weaving.

Second Division.

Treadle weaving, including decomposition of patterns of plain stuffs, in the following gradations :

1. Principles of the ground material. Decomposition of the groundwork into separate cordings, with regular and irregular draughts.
2. Decomposition of combined stuffs, with two, three, and four, or more warps of similar or different materials with different cordings, with one and several treadle divisions, and with the same or differently alternating wefts.
3. The drawing out of weaving plans, and practical weaving of plain stuffs.

Third Division.

Jacquard weaving, with the decomposition of figured patterns in the following gradations :

1. Instruction as to the fittings of the jacquard system ; the jacquard machine ; principles of jacquard weaving ; decomposition and drawing out of plans for simple stuff, with the system of reading off the plans for the card-cutting.

2. Decomposition and drawing of plans for shaded, perforated, and brocaded stuffs, with one or more warps.

3. Decomposition and designing of double-faced goods, and other combinations of double stuffs with complicated cordings, such as damasks, lamas, linsey woolseys, *taille douce*, damask tablecloths, Cashmere shawls, etc., and practical weaving of figured stuffs.

4. Varieties of velvet stuffs. Decomposition and designing of plush, plain and figured ; cut and uncut velvet, with single or more sets of leaves.

5. Gauze. Decomposition and designing of the same, with one or more caulm-divisions with separate plain-cloth and binding threads. Double gauze.

6. Ribbons. Decomposition and designing of the same, with warp and weft fringes, with single, double, and mixed draughts. Analysis of borders, fringes, perforated ribbons, laces, etc. Practical weaving of the same.

7. Harness weaving of figured stuffs. Drawing of the same, and afterwards independent designing of new patterns by the scholars, (without samples to copy) in each of the different systems of weaving.

8. Explanation of steam and power-looms ; the taking asunder of the same and putting them together again ; acquiring a fundamental knowledge of their construction. Practical weaving on the same.

Fourth Division.

1. Knowledge of the raw materials. Colouring of the same.
2. Finishing of the different woven stuffs.
3. Calculation of the goods to be manufactured.

In connection with the weaving school is a school of drawing and designing. This is held in the same building, and is conducted by an able teacher. Drawing is of the utmost importance in the division of figured weaving, as the scholar, by a thorough knowledge of it, is enabled to invent new designs, and also to put them into a suitable form to be practically carried out.

This instruction is divided into two parts :

1. Free-hand drawing, consisting of drawing from copies, plaster models, and from nature, such as flowers, etc.
2. Instructions in the drawing of designs for practical weaving.

CONDITIONS OF ENTRANCE.

The school fee for the entire course (which with diligence may be completed in about a year, and includes all the processes mentioned in the foregoing prospectus) amounts to 300 marks (about 15*l.*). On entrance into the establishment, either the whole or one half of this must be paid ; in the latter case, the remainder must be discharged in three months. Anyone who does not work through

the whole course is, nevertheless, bound to pay the full amount, i. e. 300 marks.

The patterns for analysis, as well as the necessary materials for drawing and writing, magnifying glasses, reed gauge, etc., are supplied by the director, in order that a complete equality may exist. The proximate expenses of these may amount to about 60 marks (3*l.*).

The holidays consist of eight days at each of the three great festivals, and four weeks in August.

The regulations of the weaving school permit the reception of a scholar at any time.

Announcements of entrance will be received by the director of the establishment, Mr. William Rath, or by any of the undersigned trustees.

The managers, and also the teachers of the establishment, watch over the diligence and general behaviour of the pupils; and the director will be most happy, from time to time, to send a report of progress to any of the parents who may desire it.

BURGERMEISTER BLIN, *Chairman.*

CHRISTOPH ANDREAE, JUN.

THEODOR STEINKAULER.

LAMBERT DANIELS.

Trustees of the State Weaving School.

MÜLHEIM-ON-THE-RHINE,
January, 1875.

Note.—Mülheim is situated about three miles down the Rhine from Cologne. Steamboats leave the bridge of boats every half hour for Mülheim.

THE VIENNA TECHNICAL AND WEAVING SCHOOL.

This school, existing under the immediate control of the praiseworthy commission for the management of schools for artizans, aims at affording to young men the opportunity of fitting themselves for being manufacturers, factory managers, pattern drawers, and foremen in all departments of weaving, and relieving master manufacturers from the necessity of sending their sons, in early youth, to distant and expensive institutions, and of exposing them to all the risks which are connected with early separation from home, and change of circumstances.

The tuition is divided into two distinct departments.

(a) The weaving school.

(b) The school for drawing as applied to manufacturing.

The hours are so arranged that the scholar can either attend both departments, or, either the weaving school, or the pattern school alone, according to his desire.

In the weaving school the scholar will be instructed on Monday, Wednesday, and Friday from 8 A.M to 12 A.M.; in the afternoon he will work out his problems at home, and there will still be enough vacant time at his disposal for him to

attend the afternoon course at a commercial school, or to busy himself with his own private affairs.

In the school for drawing the hours of instruction are on Tuesday, Thursday, and Saturday, from 8 A.M. to 12 A.M.

In both departments instruction for assistants and apprentices is given on Sundays from 8 A.M. to 12 A.M., and on Mondays from 6 P.M. to 9 P.M.

Industrious apprentices are afforded the opportunity of receiving in their free time the theoretical knowledge so necessary for their department, and for fitting themselves to be competent foremen or masters, according to their ability.

The instruction in weaving is in two courses of one year each, and embraces in the first course :

Treadle Weaving.

Knowledge of the loom, its several separate parts, elements, and the tools and materials used in weaving. Various reedings.

The connection of the healds with the treadles.

The theory of the primary weaves, as taffeta, croiset, atlas, and afterwards the weaves of many other cloths, with a description of the heald and treadle finings as a preparation for the following analyses :

The analyses of patterns of woven stuffs, more especially of plain, striped, and checked patterns.

Small woven patterns made in the lace bobbin machines, description of these, with instruction in reproducing the designs on paper.

Weaving of table linen on shafts.

Piqués on shafts.

Right-hand twills and double cloths on shafts.

Backed and double cloths.

Velvets and similar stuffs.

Gauze.

In all the foregoing stuffs the scholar has to make all preparations, and must give all information necessary for the preparation of the material used. The material must be calculated, and its cost reckoned.

The scholar will, moreover, in this course be made familiar with the jacquard, with the various forms of harness, with the calculation of the design paper required for each cloth, with the reeding of it, etc., and will thus be prepared for the second course.

Jacquard Weaving

embraces the analysis of jacquard patterns of different materials, as, for instance :

Damasks : as

Atlas, furniture cloths, and damask table linen.

Overshot or lanced cloths, as shawls, gobelins, etc.

Piqués.

Double and backed cloths.

Tapestry and velvets.

Gauze and ribbons.

For all these cloths the scholar has to make every arrangement, to prepare the machines and material, and to draw the designs.

Further, the opportunity is given to the scholar of learning, in the preparation of the loom, all necessary handling, as well as tying knots.

The school term begins in the second half of September, and is well advertised. No scholar is received after the beginning of the course, which lasts ten months.

Everyone is entitled to admission who has passed his fourteenth year, and can show good school testimonials. Those scholars only receive testimonials who have attended the two years' course uninterruptedly, and have sent their work up for examination at the end of each course. Nothing is given out without payment. The scholars have to prepare their requisites themselves, and to pay for the patterns they get, and the material they use.

The instruction in drawing, according to the programme approved by the committee of the technical school, embraces the teaching to all the pupils of:

1. Geometrical and constructive drawing. (*a*) Rectilinear figures. (*b*) Curves. (*c*) Complicated patterns of both.

2. Free-hand drawing. (*a*) Outlines. (*b*) Shaded copies.

3. Drawing after plaster models. (*a*) In black. (*b*) Shaded, and with lights introduced. (*c*) Colours.

4. Drawing after flower models, introducing

drawing after natural flowers. (a) In water colours.
(b) In given shades.

5. Colouring, teaching of styles, and the elements of perspective in line and colour.

6. Painting of designs for special branches of industry. (a) For industrial trades. (b) For prints and tapestry. (c) For embroidery in gold and silk.

7. Instruction in making patterns for all branches of textile industry.

There is a library of one hundred and six volumes, more than ninety of which are works on design from ancient to modern times.

Every good new work that is published is added to the collection. These works serve both as patterns for beginners, and as materials for the compositions of the most advanced students.

A large collection of the best casts from the museum and from the best studios in Vienna serve as models for the students, and the collection is yearly increased. Former scholars can always attend during school hours, and obtain advice and help.

The whole instruction is free ; no private lessons are given in drawing.

L. ANTL, *Director*.

PROSPECTUS OF THE HIGH SCHOOL FOR
WEAVING AT CREFELD.

This institution is intended to fit the scholars for manufacturers, foremen, and designers, on the following plan of instruction :

I. *Theoretical Teaching of Weaving.* (*Four hours weekly.*)

1. Teaching on weaving materials, especially cotton, flax, wool, silk, and the preparation of them for weaving.

2. The derivation of the different weaves from the first principles, taffeta, huckaback, and satin ; and the various ways of threading and adjusting them.

3. Explanation of the different looms and machines.

II. *Technical Teaching.* (*Twenty-four hours weekly.*)

1. The preparation of the warp and weft before weaving. Twisting, carding, beaming, and spooling.

2. Analysis of stuffs, in preparing which cards and treadles, or carding machines, are used ; as linen, Orleans, cachenet, taffeta, huckaback, satteen, double cloths, satinette, etc.

3. Analysis of fancy goods. To understand these, descriptions will be given of the uses of the different

machines and tools used in jacquard weaving. Then follow the analysis and designing of the most various patterns, as clothing and vesting stuffs, figured materials, for the preparation of which reeds, treadles, or healds are needed ; parasols, piqués, cashmeres, matelassés, brochés, double cloths, etc.

4. Analysis of velvets. (a) Smooth velvet and plush. (b) Small-figured, cut and uncut, velvet ; (c) Figured velvets ; one and more cord, lanced, and with scalloped edges.

5. Analysis of velvet ribbons. (a) Smooth velvet ribbon, fast edged, and with looped threads. (b) Small figured and fancy velvet ribbons, one and more cord, and with fast head-ends.

6. Analysis of stuff ribbons. (a) Plain and fancy ribbons. (b) Ribbons with weft and warp fringes. (c) Figured ribbons with quilted warps.

7. Analysis of gauze in one and more reeds, with different fast taffeta and knot threads, English cord, and double gauze.

III. *Teaching of Preparation of Draughts. (Twelve hours a week.)*

In this course draughts will be prepared both from dictation of the teacher, and from patterns and samples of all kinds of fabrics ; and the scholars will be taught to make patterns themselves of any given kind.

IV. *Free-hand Drawing. (Four hours a week.)*

Drawing and painting, after copies, models, and nature.

V. *Practical Exercise in the Separate Operations of Weaving. (Twenty-four hours weekly.)*

The scholars will be shown and practised individually by turns in all these operations, under the guidance of the teacher. This instruction follows the technical instruction in weaving, so that the arrangement of various materials found by analysis is illustrated on the machines and tools which are used.

General Remarks.

The institution has for teaching a complete weaving apparatus, consisting of the preparatory machines, looms, and power-looms, of all kinds, for illustrating the chief kinds of materials on which practical weaving can be taught. To find illustrations which the institution itself cannot offer, excursions will be conducted by the teachers to neighbouring mills.

Fees, 40 thaler.

Poor scholars may have a part of their fees remitted.

New courses begin 1st of April and 1st of October, and each course is one year.

CARL PESCH, *Director.*

TRANSLATION OF THE PROSPECTUS OF THE HIGH
WEAVING SCHOOL AT CHEMNITZ.

The High Weaving School in Chemnitz has now been in existence since Easter 1867. Thanks to the powerful assistance of the Royal Minister of the Interior of Saxony, and also of the municipality of Chemnitz, the directors have been able to mount looms and all the various machinery required for the different branches of the weaving trade. These have been erected in large and well-lighted buildings, set apart entirely for the school's own use.

The school, moreover, possesses its own steam power, by which the variously constructed looms serving the purposes of instruction are set in motion.

By the acquisition of some new looms and machinery, the directors have been able to fill up several deficiencies which hitherto have been felt, especially in the power-loom weaving department.

The institution is managed by a staff of experienced masters, under the supervision of the undersigned directors; and by giving thorough and extensive instruction, both theoretical and practical, it aims at imparting an efficient knowledge in all the various branches of the weaving trade, to the master-manufacturer as well as to his managing overlooker. At the same time, an opportunity is given to young persons who intend entering the

service of merchants, either as buyers or salesmen, to acquire a thorough understanding of manufacturing, and consequently a correct judgment of manufactured goods.

Every Easter and Michaelmas a fresh term for a full year commences, and consequently students may enter for one of them either at Easter or Michaelmas.

The plan of instruction is so arranged that it would be possible to attend instruction in certain special branches only. But in such cases the directors reserve their decision whether this may be admitted or not.

The plan of instruction consists of two parts, and comprises :

(A) *First Half-year.*

1. Lectures on weaving material.
2. Lectures on construction and systems of the various hand-loom and other supplementary machinery belonging to the weaving.
3. Dissection of plain, and also, as far as possible, of jacquard stuffs. Drawing the designs and making the calculations of the patterns thereof ; and in connection with this, instruction about construction of looms, and about the finishing of goods.
4. Practical exercise in plain weaving.
5. Composition.
6. Lectures on machine elements and motion,

and also making out drawings required for the instruction in power-loom weaving.

7. Instruction in sketching parts of machinery, and free-hand drawing.

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(B) *Second Half-year.*

1. Lectures on power-looms, and also on preparing and supplementary machines, for power-loom weaving.

2. Practical exercise in power-loom weaving.

3. Composition.

4. Dissection of jacquard stuffs, velvets, gauzes, ribbons, etc.; and in connection with this, the necessary instruction in the construction of looms, and in the finishing of goods.

5. Lectures on construction and fitting up of jacquard looms, as well as other complicated looms.

6. Practical instruction in jacquard weaving, including velvets, gauzes, ribbons, etc.

7. Free-hand drawing, composition of coloured patterns, instruction in designing.

Terms of Admission.

Applicants for admittance must have passed the regular school standard, and must at least be fourteen years of age.

As a rule, scholars are only entered for Easter

and Michaelmas, or shortly afterwards. At any other time the special license of the directors is required. The fee for the year is 13*l.* 10*s.*, and 9*l.* is paid in the first half year, and 4*l.* 10*s.* in the second half. The fee for the half year only is 9*l.*

In cases where scholars only want to attend certain special parts of the lectures and instructions, the fee is to be fixed by the directors. In all cases however the fee has to be paid beforehand.

The patterns for dissection, and materials for weaving, are provided by the school, the latter ones especially in order to procure uniformity.

As an average deposit for weaving materials in the hand-loom department, 30*s.* must be paid on admission; if the scholar uses more, the difference will be charged extra, whereas, on the other hand, anything he saves will be refunded. In exchange for this, the scholar will be allowed to retain all the stuffs he has woven, at the end of the course.

The cost for the patterns dissected is charged specially to every scholar.

In the power-loom weaving department the cost of the material is covered by the sale of the goods woven.

Applications for admittance are to be made to the undersigned directors, producing at the same time the customary legitimations and certificates about the last occupation, etc.

Every scholar who has attended to all the

various parts of instruction for at least half a year, will get a certificate on leaving the school.

Besides this, every three months certificates are given about diligence, attendance, and progress.

The directors reserve for themselves the power in special cases to distinguish scholars by premiums or written testimonials.

The directorate of the High Weaving School,
Advocate Alderman SCHMIDT,
Chairman.

Government Councillor and
Professor BÖTTCHER,
*Director of the Royal High
Trade School.*

Alderman LOUIS VOIGT,
T. W. SCHOTT,
Manufacturers.

WEAVING SCHOOL AT MULHOUSE.

Established in 1861, this school is to give young men an opportunity of studying both the theory and practice of weaving all kinds of goods. The number of establishments carrying on, at the same time, both spinning and weaving, being considerable, it has seemed both economical and useful to teach the students of the school of weaving, at the same time, also spinning; all necessary machines and apparatus, both for explanation and practical work, are at the disposal of the students.

The students quitting the school with certificates of proficiency are in a position to be of great service to the mills which engage them.

The school is managed by a committee of the heads of the chief mills in the neighbourhood on a manufacturing footing, and is a complete model mill, with condensing engine of twelve horse-power.

The machines in the weaving division comprise power-looms of one, two, three, four, and six shuttles. All the modern improvements, both of French and English make, in jacquards, healds, and pedals, hand-looms, etc., and a complete series of preparing machines, such as winders, warping frames, etc.

The machines in the spinning division are : beetles, cards, combs, spinning frames, self-acting mules, and hand-slabbing machines.

Course of Study : First, Theoretical ; and Second, Practical.

The theoretical division embraces the whole theory of manufacture, the uses of various materials, and cost of manufacture ; and is principally made up of the analysis of every kind of cloth and fabric, and the special study of those tissues which are most adapted for our manufacture.

The practical part comprehends mechanics applied to weaving, and the knowledge of various machines, manual work, and the manufacture of the chief articles already analysed ; the preparing

and weaving by the pupil himself of various patterns, under the supervision of experienced masters.

This course concludes by the study of the best methods of inventing new materials, and the drawing of designs.

Spinning.

The *theoretical* part consists of a course upon spinning, and the design of machines; and ends by the study of the best methods of making new kinds of threads for plain and backed goods, making plans and designs, calculating the cost price, the losses from waste, and the nett cost of the thread.

The *practical* course comprehends manual work and practice on the machines.

Pupils who cannot attend the lectures at the same time as their practical lessons, are allowed to attend afterwards.

The pupils are expected to occupy their evenings in calculation, and other work given to them.

Terms of Admission.

The students can follow either the course of spinning or that of weaving, according as they desire, or they may attend both. The fee for admission to the theoretical and practical course of spinning, or the theoretical and practical course of weaving, is 600 francs, 300 francs payable at once and 300 francs at the end of three months. The fee for only the theoretical course of either spinning or weaving is 400 francs; that for the

practical course of either branch is 450 francs. Those who have followed either the complete course of spinning or that of weaving, can attend the other course for an additional payment of 300 francs.

Each course lasts about a year.

At the end of the course an examination is held, and certificates of two degrees of merit are given.

EMIL FRIES, *Director.*

